# NAVAL POSTGRADUATE SCHOOL
# MONTEREY, CALIFORNIA






# THESIS

**U.S. ARMY RESERVE RECRUITING:
A CRITICAL ANALYSIS OF UNIT COSTING
AND THE INTRODUCTION OF A LIFE CYCLE
COST-EFFECTIVENESS MODEL**

by

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December, 1994

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# REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188



| 1. AGENCY USE ONLY *(Leave blank)* | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | December 1994 | Master's Thesis |

| 4. TITLE AND SUBTITLE U.S. ARMY RESERVE RECRUITING: A CRITICAL ANALYSIS OF UNIT COSTING AND THE INTRODUCTION OF A LIFE CYCLE COST-EFFECTIVENESS MODEL | 5. FUNDING NUMBERS |
|---|---|
| 6. AUTHOR(S) Daniel G. Mitchell | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>Naval Postgraduate School<br>Monterey CA 93943-5000 | 8. PERFORMING ORGANIZATION REPORT NUMBER |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER |

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

| 12a. DISTRIBUTION/AVAILABILITY STATEMENT<br>Approved for public release; distribution is unlimited. | 12b. DISTRIBUTION CODE |
|---|---|

13. ABSTRACT *(maximum 200 words)*

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| 14. SUBJECT TERMS Army Recruiting, Recruiting, Life Cycle Cost, Unit Costing | | | 15. NUMBER OF PAGES 118<br>16. PRICE CODE |
|---|---|---|---|
| 17. SECURITY CLASSIFICATION OF REPORT<br>Unclassified | 18. SECURITY CLASSIFICATION OF THIS PAGE<br>Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT<br>Unclassified | 20. LIMITATION OF ABSTRACT<br>UL |

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18 298-102

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Submitted in partial fulfillment
of the requirements for the degree of

**MASTER OF SCIENCE IN MANAGEMENT**

from the

**NAVAL POSTGRADUATE SCHOOL**
**December 1994**

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# LIST OF ACRONYMS

| | |
|---|---|
| ADT | Active Duty for Training |
| AFQT | Armed Forces Qualification Test |
| AGR | Active Guard Reserve |
| AIT | Advanced Individual Training |
| AMCOS | Army Manpower Cost System |
| ASVAB | Armed Services Vocational Aptitude Battery |
| BT | Basic Training |
| DoD | Department of Defense |
| FORSCOM | Forces Command |
| FTS | Full Time Support |
| GED | General Educational Development |
| HQDA | Headquarters, Department of the Army |
| HSDG | High School Diploma Graduate |
| IADT | Initial Active Duty for Training |
| IDT | Inactive Duty Training |
| IMA | Individual Mobilization Augmentee |
| ING | Inactive National Guard |
| IRR | Individual Ready Reserve |
| JPM | Joint-Service Job Performance Measurement/Enlistment Project |
| MEP | Military Entry Processing |
| MSO | Military Service Obligation |
| NPS | Non-Prior Service |
| OMA | Operations and Maintenance, Army |
| OMAR | Operations and Maintenance, Army Reserve |
| OMB | Office of Management and Budget |
| OSD | Office of the Secretary of Defense |
| OSUT | One Station Unit Training |
| PS | Prior Service |
| RCCPDS | Reserve Component Common Personnel Data System |
| RPA | Reserve Personnel, Army |
| TPU | Troop Program Unit |
| TRADOC | Training and Doctrine Command |
| USACEAC | United States Army Cost and Economic Analysis Center |
| USAR | United States Army Reserve |
| USAREC | United States Army Recruiting Command |

# ACKNOWLEDGMENTS

I would like to extend my sincere appreciation to Dr. Katsuaki. L. Terasawa and Dr. Keebom Kang for all of their guidance and patience during the process of preparing this thesis.

I would like to thank the entire United States Army Recruiting Command Staff at Fort Knox, Kentucky for their assistance in this research effort. I would especially like to thank Ms. Carol Moll and Ms. Marion Mueller in the Resource Management Office for their assistance in obtaining unit cost information.

I am grateful for the many hours of effort from the staff of the Defense Manpower Data Center in providing me with the data I needed on Reserve component cohorts, namely, Mr. Pat Kelly and Mr. Wayne Woo.

Also, I would like to thank the numerous people who provided wise counsel and perceptive advice from the Office of the Assistant Secretary of Defense, Personnel and Readiness; Office of the Deputy Chief of Staff, Personnel; Office of the Chief of Staff, Army Reserve; United States Army Reserve Command; and the Army recruiters at the Salinas, California recruiting station.

And mostly, my love and thanks to my family who provided support and understanding during the past eighteen months.

# I. INTRODUCTION

## A. BACKGROUND

The United States Army Recruiting Command (USAREC) and the United States Army Reserve (USAR) face increasing scrutiny from Congress to justify the cost-effectiveness of their manpower procurement policies. Changes in the world economic and political environment, domestic concerns, and budgetary impacts challenge the Department of Defense (DoD) to develop a military force mix to meet future defense needs at an affordable cost. The end of the cold war led to a reduced national security threat, and the reduced threat led to reductions in force structure and manpower requirements. Part of the DoD solution to control the cost of the Total Force has been to increase the size of the Reserve component relevant to the size of the Active component. A substantial Reserve force is less expensive to maintain than a similarly sized Active force, and it helps reduce the risks associated with a smaller Active component. From a USAR perspective, this change has meant increased roles and missions and increased scrutiny of manpower procurement policies. Thus, our goal in this research effort is to help Reserve manpower policy makers achieve economic efficiency.

The USAR manpower procurement policies focus mainly on balancing the costs and benefits of non-prior service (NPS) and prior service (PS) recruits and setting the quality[1] content of the accession year group. The Reserves depend heavily on the flow of PS soldiers from the Active component to provide a supply of trained and experienced personnel. While PS soldiers require little training and recruiting investment, they do not always possess the job skills needed by local Reserve units. On the other hand, NPS soldiers can be trained to meet local unit requirements, but they require substantial recruiting and training investments. While it is clear that USAR units require some mix of NPS and PS soldiers to meet local skill and job requirements, decision makers at the

[1] In the Army and USAR, quality of recruits is defined by educational attainment and scores on the Armed Forces Qualification Test (AFQT).

macro level do not have the information nor tools needed to determine a cost-effective mix. Presently, Congress, the Department of Defense (DoD), and the USAR rely heavily on the unit cost per accession data provided by USAREC for estimating recruiting costs and allocating resources.

USAREC has been using the unit cost resourcing approach since FY 91. DoD intended this "business-type" accounting approach to provide improved decision making information and incentives for USAREC to cut costs. However, an analysis of this approach uncovers limitations which impede these goals. Among other problems, the unit cost approach implies that all recruits have the same accession cost. This is clearly wrong as different categories of recruits require different levels of processing, advertising, incentive bonuses, and recruiter time to access. Furthermore, unit cost only provides a "snap shot" of costs and does not consider the life cycle implications associated with manpower procurement. Decision makers should use marginal costs and life cycle costs when drafting accession policy and allocating budgets.

Thus, this thesis addresses two distinct issues that face USAREC and the USAR today: USAREC's implementation of DoD's unit cost resourcing and the development of an analytical model to evaluate and justify accession policies.

## B. OBJECTIVES AND SCOPE OF THESIS

The three main objectives of this thesis are as follows:

1. Provide an overview of the Army Reserve recruiting process;
2. Discuss the unit cost per recruit formulation for USAREC's Reserve recruiting mission and identify its limitations;
3. Develop and demonstrate a life cycle cost-effectiveness methodology for evaluating alternative Reserve accession policies.

## C. METHODOLOGY

The research began with gaining a comprehensive understanding of the Reserve recruiting process. Besides a literature review, the research included interviews with

members of the USAREC staff at Fort Knox, Kentucky and phone interviews with members of the Office of the Secretary of Defense, Accession Policy; Office of the Chief of Staff, Army Reserve; U.S. Army Reserve Command; and local recruiters.

The next step was to collect data on unit cost resourcing at USAREC as it applies to the Reserve recruiting mission. The study looked at the relationships between expenditures and accessions, actual and projected, to critique the use of unit cost as a management tool.

The process for developing the life cycle cost-effectiveness model began with collecting data from the Defense Manpower Data Center (DMDC) on two year groups of USAR Selected Reserve gains. This information was used to determine attrition and promotion behavior for each type of recruit over a seven year life cycle. We used an off-the-shelf Army Reserve manpower cost model to estimate recruiting, training, and compensation costs for each type of recruit under study. Using soldier behavior and cost information in a micro-computer spreadsheet program, we calculated periodic cash flows for each policy alternative. The research concludes with a demonstration of the life cycle cost-effectiveness methodology to evaluate alternative accession policies.

## D. LIMITATIONS

This research is limited to a macro-analysis of Reserve accession policy. The study only considers aggregate supply and demand of recruits for the USAR Selected Reserve In reality, the supply of recruits for a unit is determined by the size of the local population, the propensity of citizens in that area to enlist, and the number of PS soldiers who reside in that area. The demand for recruits is determined by the needs of the Reserve unit in a region. The optimum accession policy would consider the supply and demand of recruits for each region and draft accession policy accordingly. However, a micro-analysis is beyond the scope of this thesis and not in accordance with current policy making.

Furthermore, the validity of the life cycle cost-effectiveness analysis is limited by the ability of the cost estimating relationships to estimate true costs and the ability of the

attrition and promotion data to predict future soldier behavior. The soldier data and cost estimates are merely used to demonstrate the usefulness of the life cycle cost-effectiveness methodology to evaluate policy alternatives.

## E. ORGANIZATION OF REPORT

Chapter II provides an overview of the Army Reserve structure and the Reserve recruiting process. The discussion includes information on Reserve roles and missions, composition of the USAR, Total Force supply and demand issues, and an overview of the Reserve recruiting process. A comprehensive understanding of these topics is essential to evaluating Reserve manpower accession policy.

Chapter III provides an in depth analysis of USAREC's implementation of the unit cost resourcing concept to Reserve recruiting. The discussion begins with DoD's stated objectives of unit costing, examines the inputs and outputs of the unit cost calculation, and ends with a critique of the usefulness of unit costing to accomplish the stated objectives in the recruiting environment.

Chapter IV introduces a life cycle cost-effectiveness methodology for evaluating USAR Selected Reserve accession policy. The chapter presents the demographic characteristics, attrition rates, and promotion rates for the cohorts used in the study. This information is used to predict the behavior of recruits over time based on aptitude, education level, and military experience. The discussion includes the cost estimating relationships used in the model and requisite assumptions made to simplify the analysis. Finally, this chapter presents the use of the model to evaluate Reserve accession policy alternatives.

Chapter V contains a summary of the research, final conclusions, and recommendations.

# II. THE RESERVE RECRUITING PROCESS

## A. INTRODUCTION

Since the inception of the Total Force Policy in 1973, the Reserve components have primarily been sized and structured to support the missions of the Active component. However, their mission is expanding as the nation strives to become more cost-effective in the post-Cold War era. New Reserve component operations include peacekeeping, peace enforcement, humanitarian assistance, and disaster relief. As recently as November 24, 1994 Secretary of Defense, William Perry, approved a plan to use reservists in many peacetime roles now performed by regular forces. For example, in January of 1995 the Army will send a battalion of 430 reservists for a six month rotation to the Sinai to be part of a multinational observer force [Ref. 1]. The Secretary of Defense expects that the Reserve components will provide "compensating leverage," which means using the Reserve components to reduce the risks associated with a smaller Active force and controlling the costs of the Total Force [Ref. 2, p. 3]. Figure 1 illustrates the shift in the Army Total Force composition from 1980 to 1994 [Ref. 3, p.44].

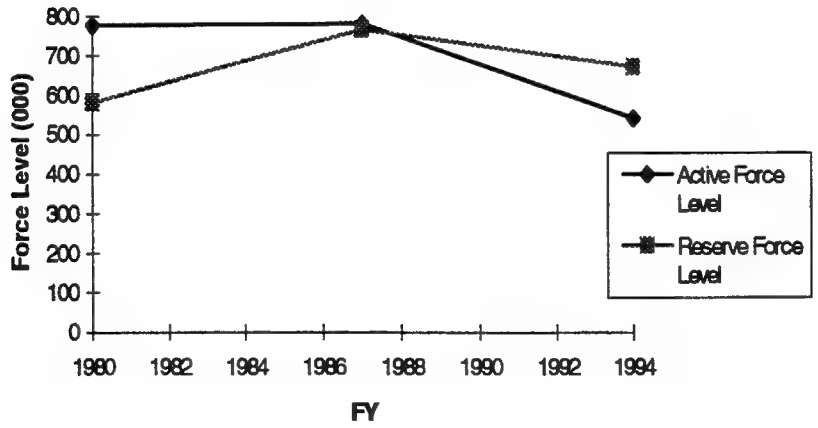


Figure 1: Army End-Strength Levels, Fiscal Years 1980-1994.

The Reserve components provide a cost-effective means for augmenting the Active component and maintaining important capabilities in the Total Force. The cost of maintaining mission capabilities in the Reserve components should be measurably less than the cost of maintaining equivalent readiness in the Active component. Furthermore, the citizen soldier provides a deterrent to conflict and a critical surge mobilization capability. Thus, the Reserve components remain ideally positioned to enhance national security with efficient and cost-effective forces. The current trend in the force structure and Reserve roles and missions suggests that the nation will depend more on the Reserve components to respond to ever-changing world events.

Because of the increased roles of the Reserve components, policies and legislation that affect personnel strength levels are perhaps more important today than ever before. The efficient management of Reserve component personnel is essential to the continued success of the Total Force.

## B. COMPOSITION OF THE ARMY RESERVE

Reserve component personnel are assigned to one of three categories: the Ready Reserve, the Standby Reserve, or the Retired Reserve. All National Guard members are in the Ready Reserve. A schematic of the U.S. Army Reserve (USAR) composition is illustrated in Figure 2.

The Ready Reserve consists of the Selected Reserve, the Individual Ready Reserve (IRR), and the Inactive National Guard (ING). Some personnel are organized in units, and others train as individuals. All are subject to recall in time of war or national emergency.

The Selected Reserve is comprised of Reserve component personnel assigned to units, Full-Time Support (FTS) positions, and individuals who serve as Individual Mobilization Augmentees (IMAs). These individuals and units are considered so important to initial wartime missions that they have priority over all other Reserve components [Ref. 2, p. 5].

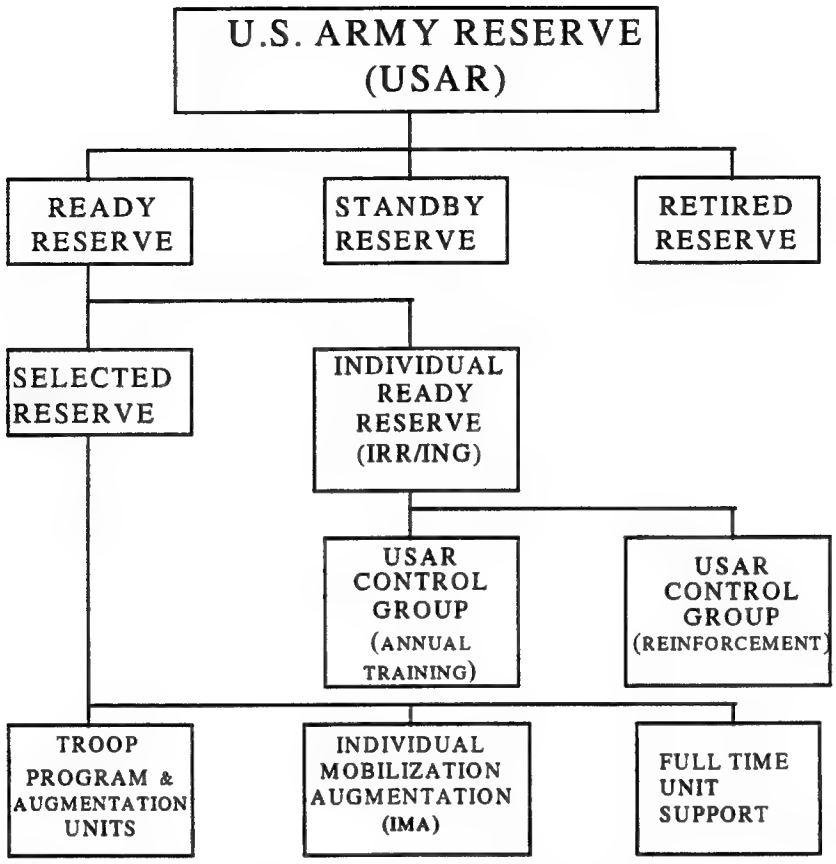


Figure 2. Composition of U.S. Army Reserves. After Ref. [4].

Selected Reserve units may be either operational Troop Program Units (TPUs) or augmentation units. TPUs train and deploy as units. Augmentation units train as units in peacetime but are absorbed into Active units upon mobilization. Selected Reserve units are manned by drilling members of the Reserve components and have a cadre of Full-Time Support personnel. Selected Reservists who have not completed initial training are subject to mobilization but cannot be deployed outside of the United States until completion of initial military skills training and job training.

Troop Program Units (TPUs) comprise the majority of the Army's combat service support capability. In some mission areas, the Selected Reserve provides as much as 100 percent of the Army's support capabilities. The Reserve also provides over 70 percent of the medical assets for the Army.

The Individual Mobilization Augmentation (IMA) Program provides trained individual members of the Selected Reserve to augment Active component commands and organizations which have wartime requirements above their peacetime strength authorizations. The IMA rolls currently contain about 75 percent officers.

The Individual Ready Reserve (IRR) and Inactive National Guard (ING) provide a pool of skilled and experienced soldiers as individual replacements. The IRR and ING members are principally comprised of trained individuals who previously served in the Active component or Selected Reserve and have some period of their military service obligation remaining. These reservists will augment and fill Active Army and Army Reserve units during mobilization. Additionally, the USAR IRR has a number of control groups such as the USAR Control Group, Annual Training, consisting of non-unit members with less than three years of Active component duty who have a military service obligation to complete. The Control Group, Reinforcement, is comprised of non-unit members with over three years of Active component duty with no training requirements. Both control groups are liable for mobilization and limited involuntary active duty for training. They may train voluntarily for retirement points and promotion, with or without pay.

The Standby Reserve consists of personnel who are not required to train and are not assigned to units. This manpower pool of trained individuals could be mobilized if necessary to fill needs in specific skills. Most have completed all Ready Reserve obligations but have yet to complete their military service obligations. These individuals could be mobilized to fill specific manpower needs if the Secretary of the Army and Secretary of Defense determine that there are not enough qualified reservists in the Ready Reserve.

The Retired Reserve consists of personnel who have completed at least 20 or more years of qualifying Federal military service in either the Active Army or one of the Reserve components. In all cases, the last eight years must have been spent in a Reserve

component. Retirees can be called to active duty to fill critical shortages in times of war or national emergency.

The composition of the USAR at the end of FY 93 is illustrated in Figure 3 showing the relative sizes of the various categories of personnel discussed above.

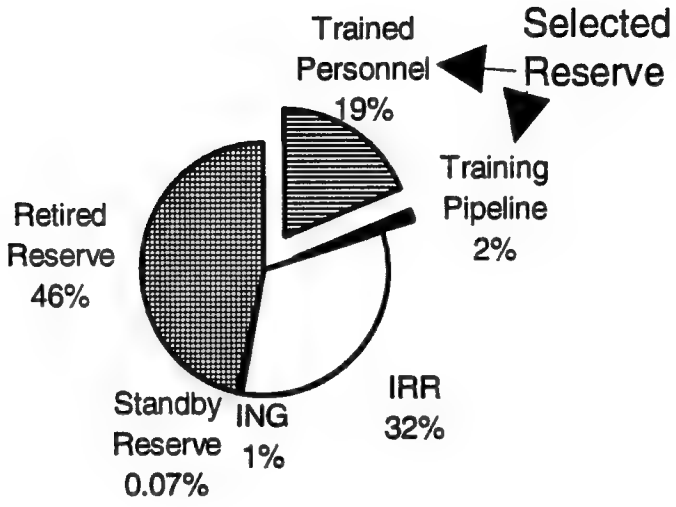


Figure 3: Total Army Reserve Strength. After Ref. [2]. Data as of September 30, 1993.

The Army Reserve mission is to provide trained personnel for military preparedness. As mentioned above, the majority of the Reserve's immediate mission capability comes from the Selected Reserve. These citizen soldiers attend monthly meetings of at least 16 hours (usually two eight-hour days over a weekend), plus they serve for two weeks each year at Annual Training. The Reserve soldier receives the same pay and benefits as his Active component counterpart while serving periods of active duty such as Annual Training. These pay and benefits will be considered in detail in the life cycle cost-effectiveness section of this report.

## C. MANPOWER PROCUREMENT ISSUES

This section addresses the issues that face military personnel managers in shaping the force and drafting accession policy. Indeed, the services are unique in terms of how they recruit and retain personnel, as well as in how they manage careers. Within each service, the military personnel system is a centrally managed, "closed" system, meaning that persons recruited with no prior military service are generally brought in at entry level positions and progress through the ranks. On the other hand, an "open" system, as used in the private sector, allows new hires into an organization at various levels depending on the person's qualifications and experiences [Ref. 3, p. 13]. Although the Reserves allow PS soldiers into their organization based on qualifications, these hires are considered internal. Further, the military personnel system operates under an "up-or-out" policy in which members who fail to receive promotions within specific time frames are limited to how long they can remain in the service. In fact, the services lose significant numbers of personnel for a variety of reasons each year. DoD indicates that it has not been unusual to replace more than 15 percent of the Active component personnel and 27 percent of the Reserve component personnel each year even when the authorized end-strength levels are at a relatively "steady state," neither increasing nor decreasing significantly [Ref. 3, p. 14]. Thus, the Reserve must recruit enough PS and NPS members to replace losses and ensure that they will have enough well-trained personnel to meet and sustain future years' seniority, grade, and experience requirements.

Furthermore, there is a critically important link between Active and Reserve forces' personnel policies. The Reserves rely heavily on the flow out of the Active component. Thus, the trends in Active force staffing dramatically affect the manpower policies in the Reserve forces. Figure 4 illustrates the framework of Total Force supply and demand for enlisted military personnel for both the Active and Reserve forces. Starting from the left of the chart, the "Eligible Pool" represents the demands for NPS accessions into the Active and Reserve enlisted ranks from the available pool of male and female youth.

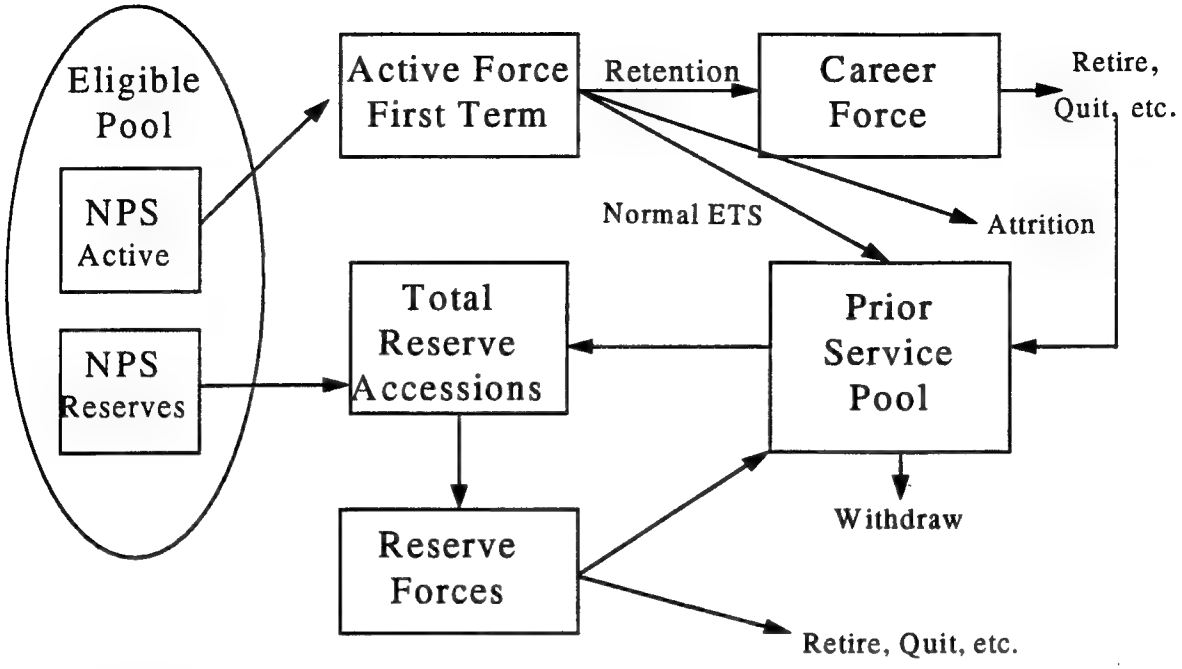


Figure 4: Total Force Supply and Demand. From Ref. [5].
NPS = Non-Prior Service, ETS = Expiration of Term of Service.

Every Active component soldier enlists for an initial Military Service Obligation (MSO) of eight years[2]. Up to six years may be on Active component duty. The remainder of the obligation may be served in a Reserve component unless there is a determination that there is "no potential for useful service under conditions of full mobilization." [Ref. 6] Some first term soldiers will fail to complete their first term of Active component enlistment due to disciplinary problems, performance problems, hardships, or any number of reasons. These soldiers are identified by "Attrition" in Figure 4. Most soldiers complete their Active component service, complete the remaining portion of their MSO in the IRR, and never volunteer for service in the Selected Reserve. Other soldiers complete Active component service and, at some point following their expiration of term of Active component service (ETS), join a Selected Reserve unit. Other soldiers reenlist and enter

[2] The eight year MSO applies to all soldiers enlisting on and after June 1, 1984. Prior to this time, the MSO was six years for all enlistees.

the career Active component force. A RAND study showed that about 40 percent of the Active Army's first-term soldiers who do not reenlist at the end of their first term join the Army's Reserve components. About a fifth of each exit cohort make an immediate commitment to join a Reserve unit before returning home [Ref. 7, p. xii]. The Reserves rely heavily on the flow of prior Active service soldiers. These soldiers provide the Reserve component with a critical source of experienced, trained soldiers who can immediately enhance the readiness of the Selected Reserve at a minimal cost.

This section identified some of the major issues that face military personnel managers when drafting accession policy as part of the overall personnel management scheme. Because of the Army's unique "bottom-fed" system, both the Active and Reserve components have to recruit a significant number of the right kinds of personnel to maintain a balanced force. Since the Reserve component relies heavily on the flow of experienced personnel from the Active component, they have the added task of determining the right mix of NPS to PS accessions

### 1. Demand for Enlistees

Military demand for enlistees is a function of the strategic requirements process as opposed to achieving a free market equilibrium. For the USAR, Selected Reserve strength requirements largely determine demand for enlistees. In establishing accession rates to sustain a future Selected Reserve force, the USAR must examine historical trends in attrition and replacement rates, factor in the probabilities of how long individuals are likely to remain on Selected Reserve status, and apply an algorithm to calculate replacement or accession rates per year. The Selected Reserve must also consider the "youth to experience" ratio when determining accession levels and shaping the force in order to minimize skill imbalances and promotion stagnation. Figure 5 shows the trend in Reserve component accessions from FY 80 - 93 and projections to the year 2001. Despite recent reduced end-strength levels, projected accession rates remain high to preserve and sustain a balanced force in the future.

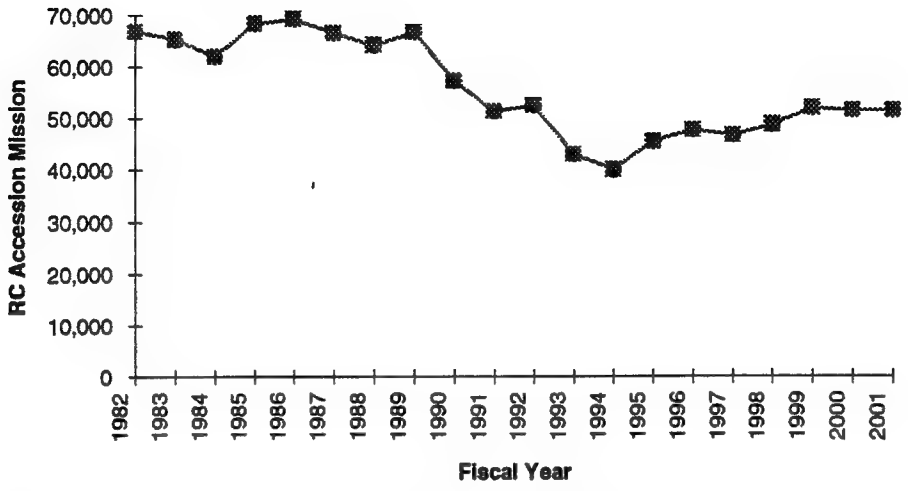


Figure 5: Actual (1982-1993) and Projected (1994-2001) Trends in USAR Accessions. (Source: USAREC).

The USAR breaks the demand for applicants into two main categories, NPS and PS. NPS applicants require a substantial training investment, but they can be trained as needed to fill occupational shortages. PS recruits do not offer as much MOS flexibility, but they require little or no training investment and offer greater experience. The demand for NPS soldiers is often constrained by the number of available seats at training schools and the requisite training funds. The demand for PS soldiers is often limited by the number of vacant positions of the correct grade and occupation. Also, PS soldiers, because of their higher average rank, are not suited to fill the numerous lower grade positions in the Selected Reserve. Thus, accession policy planners must attempt to balance the trade-offs associated with NPS and PS soldiers when drafting policy. The FY 93 NPS and PS accession mix was about 43 and 57 percent, respectively.

In 1993, the 102nd Congress enacted legislation called the Army Guard Combat Readiness Reform Act to enhance the readiness of the Army National Guard. The legislation called for, among other things, a minimum percentage of 50 percent Active duty enlisted personnel in the Army National Guard by 1997. The Army Reserve is

following the Guard's lead to obtain the minimum percentage of qualified PS personnel by 1997 [Ref. 2, p. 176]. As of September 30, 1993 the Army Selected Reserve had 43 percent of their inventory with two or more years of Active component service [Ref. 2, p. 78]. To meet the 50 percent PS goal, the Reserves will have to continue to recruit a greater percentage of PS soldiers.

Retention of qualified Reserve soldiers through reenlistment after the first term and throughout a career impacts heavily on demand and readiness. Retention also reduces recruiting and training costs. Because of the Army's "bottom-fed" system, the more soldiers that stay in, the fewer that need to be accessed and trained. With fewer people in the training "pipeline," the Selected Reserve has lower training costs and more soldiers in deployable status. Since, the Reserve cannot deploy untrained soldiers, they should seek to minimize attrition to decrease investment costs and improve deployability of the force.

Attrition from failure to reach the end of the first enlistment term or failure to reenlist results in the loss of trained personnel and a substantial training investment loss. Although some attrition is desirable to preclude stagnation and provide opportunities for upward mobility, retention of adequate numbers of trained personnel is essential to maintain readiness and to lower life cycle costs. The attrition rate for USAR Selected Reserve soldiers in the grade of E1 to E5 was 34 percent in FY 92 and 40 percent in FY 93. A recent survey showed that commitment to the Army Reserve and intent to stay beyond current obligation are at their highest levels in over five years. Despite these positive results, downsizing of the force has negatively impacted attrition rates. The primary reasons for attrition are voluntary or involuntary transfer to the IRR, transfer to an Active component, and ETS. [Ref. 2, p. 66] Since attrition has such a dramatic impact on readiness and force costs, manpower planners should always consider its effects when drafting accession and retention policy.

### 2. Supply of Applicants

Figure 4 shows that the supply for the Army Reserve comes from an eligible pool of NPS and PS applicants. The supply of enlistees depends on a variety of factors. According to R.V.L. Cooper:

> It is convenient to categorize those factors that are expected to influence individual's propensities to seek employment in the military into several major groups: 1) the tangible aspects of military employment; 2) the dissemination of information to potential recruits; 3) the economy; 4) the population base from which the military must draw its recruits, and 5) individuals' "tastes" for military service [Ref. 8, p. 159].

The supply of NPS soldiers for the military comes mainly from the 17 to 21 year-old male and female population. Figure 6 indicates that the size of the youth cohort eligible for military service has been increasing steadily since 1989. The youth population is projected to continue growing until at least the year 2000 when it is estimated to reach 19.6 million [Ref. 9, p. 28]. The percentage of the target population needed by the

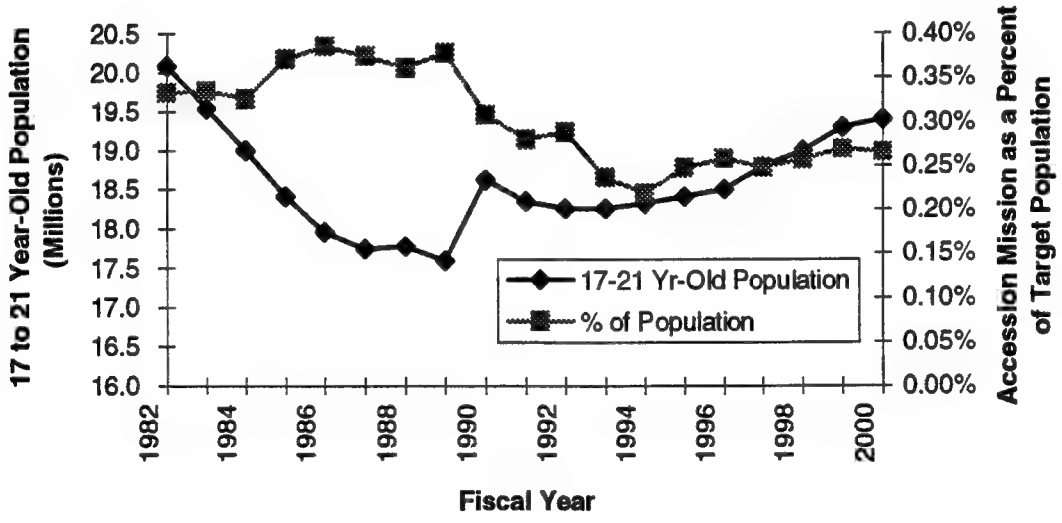


Figure 6: Trends in Market of Available Youth Ages 17-21 and Accession Mission as a Percentage of Available Youth.
Note: Figures for 1989-89 are based on 1980 census data; figures for 1990-2000 are based on 1990 census data. After Ref. [9].

Reserves to meet their accession mission has been decreasing steadily since 1989 and is projected to stabilize at about .25% until the year 2000. Given these projections, the supply of youth should be able to meet Reserve NPS accession demands in the near future, all other factors remaining the same.

The supply of available personnel for the Reserves is further reinforced by the increasing role of women in the military. The Secretary of Defense approved a recommendation to open three new Army occupational specialties to women effective 1 October 1994 representing over 32,000 additional positions. As a result, 91 percent of the career fields and 67 percent of the Army's positions will now be gender neutral [Ref. 10, p. 22]. This action significantly increases the available youth supply pool.

The supply of PS personnel for the Reserve component should also be adequate, at least in the near term. Because the Active duty force is shrinking, the number of personnel in the PS pool will increase for the next several years, at least until the turn of the century. After the turn of the century, if the relative size of the Reserve remains large, the PS supply pool may become critically low without some policy intervention [Ref. 5, p. 32].

The increase in the PS supply pool comes with the caveat that the Reserves need to match individual skills and qualifications with the regional requirements of Reserve units. Unfortunately for the Reserves, the majority of the Active component separations are in the combat arms. The majority of the Reserve's occupations are in the combat service support area. This situation will continue to force the Reserve components to manage skill imbalances and regional shortages to meet supply needs for PS accessions.

### 3. Applicant Screening Process

Applicants entering the military undergo a screening process to ensure they are qualified to serve. When the Reserves recruit PS soldiers, an evaluation of past performance can serve as the primary criterion for assignment into a specific position. However, when the Reserves recruit people without prior service, they must rely on educational attainment (high school graduation status), aptitude, and other personal characteristics as predictors of future performance. Aptitude is defined here in terms of

scores on the Armed Forces Qualification Test (AFQT), which is a sub-test of the Armed Services Vocational Aptitude Battery (ASVAB).

Literature shows the AFQT to be a predictor of trainability while high school completion is a positive indicator of perseverance to complete a tour of duty. For example, high school graduates have a substantially lower first-term attrition rate than do non-graduates. United States Army Recruiting Command (USAREC) figures for recruits entering the Active component in FY 90-91 indicate that about 60 percent of high school graduates complete their first term of enlistment compared to only about 45 percent of non-graduates. Furthermore, lower aptitude personnel generally have lower reading abilities -- typically at the fifth to seventh grade levels among AFQT category IV personnel. Also, lower aptitude personnel usually take longer to train and have higher failure rates [Ref. 11 , p. iv]. Because of the apparent link between aptitude and education and trainability and perseverance, the Army and Army Reserves use AFQT scores and educational attainment as measurements to screen NPS applicants for military service.

Table 1 shows the current quality categories expressed as AFQT percentiles with 100% being the highest score. The Army derives an individual's AFQT percentile by comparing his/her individual AFQT raw score to the test population's mean score.

The services define quality recruits as those who are high school graduates and who achieve an AFQT score in the 50th percentile or above (category I-IIIA). In 1981, Congress passed legislation applicable to all services' new recruits setting maximum limits of 20 percent category IV personnel and 35 percent non-graduates. The legislation effectively limited the number of low quality recruits entering the services. The congressional action was generated by a perceived quality crisis caused by misnorming of ASVAB test scores. The misnorming caused scores in use since 1976 to be inflated. Once the aptitude test was properly normed, the Army estimated that they had 50 percent category IV personnel. Both Congress and the services felt this level of low aptitude soldiers was too high.

| QUALITY CATEGORY | PERCENTILE |
|---|---|
| I | 93-100 |
| II | 65-92 |
| IIIA | 50-64 |
| IIIB | 31-49 |
| IVA | 21-30 |
| IVB | 16-20 |
| IVC | 10-15 |
| V | 0-9 |

Table 1: AFQT Test Score Categories(TSC)

Since the 1981 legislation, Headquarters, Department of the Army (HQDA) has raised NPS recruit quality marks for both the Active and Reserve components. Currently, the Army accession standards are as follows:

1. At least 67 percent category I-IIIA;
2. No more than 2 percent category IV;
3. Any category IV must be a high school graduate;
4. Any applicant below category IV is considered legally unacceptable. [Ref. 8, p. 127-128).

NPS applicants must also be medically and morally fit to qualify for Active or Reserve service. For instance, an NPS recruit must not have any felony convictions. The medical and moral criteria are applied on a binary basis -- the recruit is either fit or not fit for military service.

NPS applicants for the Reserve forces have to be willing to accept Military Occupational Specialties (MOSs) required by the Reserve units in their local area, and they have to be qualified for that particular MOS. Different MOSs have different AFQT score requirements. Furthermore, if the applicant does not live within 50 miles of the

Reserve unit, he or she requires a waiver, and the Reserve unit commander has the right to interview the applicant for acceptance.

In the recruit screening process, the selection of PS applicants is much more streamlined. The assumption is that if a PS applicant has successfully completed Active component service, he or she has successfully adapted to the military environment. The PS recruit screening process differs based on whether or not the PS applicant has a remaining military service obligation. If the PS applicant has a remaining obligation, their records are screened to ensure their Active component service was characterized as honorable. No other screening or processing is necessary. If a PS applicant's service obligation has been completed, their records are screened to ensure they have at least three ASVAB component scores of 90 or greater, and that they have a high school degree or General Educational Development (GED) certification. These non-obligated soldiers must also retake an entry physical.

The challenge for Reserve recruiters assessing PS applicants is matching them with regional job requirements. First, there must be a vacancy in the region the applicant lives (defined as a 50 mile radius from the Reserve unit). Second, if there is a vacancy in a local unit, the applicant must have the required MOS. If they do not have the needed MOS, retraining is required. Furthermore, local Reserve unit commanders have the option of performing job interviews with applicants to determine if they are qualified.

The military and Congress must also consider other socio-economic factors when setting recruit standards. For instance, many people feel that the opportunity to serve in the Armed Forces is an important right of citizenship. If the military is going to have a capability that requires an accession quality level that is higher than the average population from which they recruit[3], they should have compelling reasons. On the other hand, there are national security risks that can be more costly in the long run if quality standards are set too low. For these reasons, Congress is interested in the methodology the services use

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[3] As a point of reference, in 1985 about 76 percent of the mentally qualified male population was high school graduates and 75 percent fell in AFQT categories I-IIIA [Ref. 11, p. x].

to set recruit screening processes. In the Defense Appropriations Bill of 1983, Congress mandated that quality standards for first term applicants be linked to performance or readiness. Failure of the services to present a rigorous method of linking recruit quality goals to subsequent high performance has made recruiting budgets a target for reductions. [Ref. 5, p. 132]

This section provided an overview of the recruit screening process for Reserve applicants. Reserve recruiters must recruit qualified NPS and PS soldiers like their Active counterparts, but also, they must match perspective applicants to occupations and position vacancies in their regional areas. Matching NPS and PS applicants with regional shortages is the Reserve recruiter's largest constraint and challenge.

## D. RECRUITING ORGANIZATIONS

Whereas the United States Army Recruiting Command (USAREC) is the only recruiting organization for the Active component, the Reserve component has three recruiting organizations responsible for accessing soldiers -- USAREC, the Army Reserve Personnel Center (ARPERCEN), and Forces Command's (FORSCOM) in-service recruiters.

### 1. The United States Army Recruiting Command

The United States Army Recruiting Command (USAREC) personnel recruit applicants for both the Active and Reserve components. In 1993, USAREC employed 1,458 Reserve recruiters to access PS and NPS soldiers for the Selected Reserve. These recruiters are Reserve component Full-Time Support personnel in Active Guard Reserve (AGR) status. In FY 93 USAREC Reserve recruiters accessed 21,912 NPS soldiers and 21,180 PS soldiers. USAREC production accounted for all NPS Selected Reserve accessions and about 70 percent of PS Selected Reserve accessions for FY 93.

### 2. Army Reserve Personnel Center

The Army Reserve Personnel Center (ARPERCEN) is a USAR unit responsible for maintaining the IRR database and for recruiting personnel for IMAs. They also recruit personnel for Selected Reserve TPUs by screening the IRR database for qualified personnel to fill vacant positions. ARPERCEN accounted for about five percent of all Selected Reserve recruits and 10 percent of PS Selected Reserve recruits in FY 93.

### 3. In-service Recruiters

In-service recruiters encourage soldiers leaving the Active component force to join either the Army Reserve or Army National Guard. The Army places these in-service recruiters at separation points called transition centers. These recruiters access PS soldiers for TPU and IMA vacancies of the Selected Reserve. Their efforts accounted for about 10 percent of all Selected Reserve recruits and 20 percent of the PS recruits in FY 93.

This section summarized the main sources of accessions for the Army Reserves. Once recruited, all NPS applicants and PS applicants with no remaining military service obligation must process through Military Entry Processing Stations (MEPS). The MEP stations are DoD organizations regionally located in large urban areas with at least one Army representative. The MEP station's mission is to administer tests and physical exams, assign MOSs, and process recruits. The Army representative is a guidance counselor who actually assigns the recruit his/her MOS. The recruiter only "sells the Army" and does not guarantee any specific job [Ref. 12, p. 17]. A recruited soldier is not considered an accession until he or she is qualified, signs a contract with the Army Reserve to complete an obligation, and joins the training program.

## E. DELAYED TRAINING PROGRAM

Once an applicant who requires training is accessed, he or she enters the Delayed Training Program (DTP) to await a training seat. The DTP serves several purposes. First, it allows time for further background checks that could disqualify an applicant.

Second, it allows applicants to sign enlistment contracts and coordinate training to avoid conflicts with their jobs or with school. Third, it allows recruiters and trainers to coordinate accessions with training seats. In the Selected Reserve, untrained recruits are allowed to conduct limited weekend training for pay with their units. They are not deployable nor allowed to participate in the two week Annual Training until completing initial military skills training (Basic Training) and job skills training (Advanced Individual Training).

## F. MEASURES OF EFFECTIVENESS

USAREC's performance is measured by their ability to meet quantity goals, quality levels of accession cohorts, and cost per accession targets. The Department of the Army issues annual recruiting and training seat missions to USAREC. The recruiting requirement is subdivided by number of NPS and PS accessions required by quarter along with quality goals for NPS recruits and training seat requirements that USAREC is expected to fill. The USAREC headquarters sets recruiting goals for the recruiting brigades who, subsequently, set recruiting quotas for each recruiting station.

Recruiters receive their monthly mission quotas by category of applicant. Quotas are issued to ensure that USAREC achieves their quantity, quality and training seat requirements. The USAR recruiting mission is issued to recruiters in the following three mission categories:

1. High school degree graduate (HSDG) or currently in high school and AFQT category I-IIIA (no gender);
2. Prior Service (no gender);
3. Other (AFQT category IIIB-IV, high school graduates or non-high school graduates, no gender). [Ref. 13, p. 12]

USAREC is measured on how well they achieve the quantity and quality marks of their accession mission. Historical records from USAREC indicate that Reserve recruiters have been able to meet or exceed Army quality marks for NPS recruits since 1991 and

have exceeded legislative requirements and DoD targets[4] since 1980 [Ref. 14]. Furthermore, USAREC has been able to achieve 99 percent of their Selected Reserve quantity targets for the years of FY 86 to 93 (on average).[5]

## G. SUMMARY

The purpose of this chapter was to familiarize the reader with the Army Reserve composition, roles and missions, and recruiting process. This understanding forms the basis for an evaluation of Army Selected Reserve accession policy and resource allocation. The literature review conducted during the preparation of this thesis reveals that research in the Reserve policy arena is minimal. However, the increased use of Reserve forces in support of national interests makes research in this area even more crucial. The critical link with the Active component for the supply of Reserve PS manpower emphasizes the importance of considering the Total Force in all policy decisions. Although the supply of both PS and NPS applicants appears adequate to meet projected demand for the near future, long term supply of PS applicants remains in question as the Active force reaches a lower steady state level. More immediately, though, the Reserves are faced with justifying their requirements for high quality and NPS soldiers. Because these soldiers require higher initial recruiting and training investments, Congress is asking for an analytical justification that links higher investment costs with added performance. The current means of evaluating USAREC on fiscal performance is the cost per accession (unit cost). This accounting approach has many limitations when used as a recruiting policy performance measure and means for allocating resources. The next chapter will discuss the unit cost approach and its limitations as a measure of fiscal performance and means for resource allocation.

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[4] Legislative requirements: 65 percent HSDG, no category I-IIIA mark, and less than 20 percent category IV. DoD benchmarks: 90 percent HSDG, 60 percent category I-IIIA, and no category IV ceiling. Army target: 95 percent HSDG, 67 percent category I-IIIA, and less than 2 percent category IV.

[5] FY 86 - 93 was the only mission data available from USAREC at the time of this report.

# III. UNIT COST ANALYSIS

## A. INTRODUCTION

The purpose of this chapter is to analyze the unit cost method of resourcing used by USAREC and to determine its usefulness for management decision making. This analysis will identify expenditures, trends, and limitations for using this approach to evaluate effectiveness and efficiency in recruiting. Specifically, this analysis will demonstrate how unit cost figures are derived, analyze trends of costs per output, and discuss the limitations for using unit cost figures as a basis for determining performance and decision making.

## B. BACKGROUND

In 1985 political pressures focused on the rapid budget growth and inefficiency of DoD. Both President Reagan and President Bush mandated productivity improvement from DoD. In 1989, the Office of the Secretary of Defense (OSD) proposed implementing a cost per unit output system in response to the Presidents' requests. On 10 August 1989 Mr. Donald Shycoff, the Principal Deputy Comptroller for DoD, stated that DoD should use the same identification of inputs and outputs for making resourcing decisions and management decisions concerning performance, productivity, and quality improvement [Ref. 15, p. 22]. The Secretary of Defense announced that unit costing would be underway with the execution of FY 1991 operation. The Defense Logistics Agency (DLA), previously headed by Shycoff, was one of the first agencies to implement the unit cost approach. A DLA document entitled "Unit Cost Resourcing Policies and Procedure" describes unit cost as follows:

> Unit cost is nothing more than a concept that all of the costs incurred at an activity should find their way into some output measure. The idea is to use a "business-type" accounting or financial system approach. Private business must recover all of their costs through the pricing mechanism or they will soon be out of business.... The goal is to have each product or output bear as accurate a cost as possible, so that as

> the products or outputs fluctuate, the revenue and costs will remain in balance. [Ref. 15, p. 24]

USAREC calculates unit costs by dividing the total input (budget expenditures) by the total output (accessions). Under the unit cost concept, USAREC is expected to break-even each year given their expected output. Next year's budget is determined by multiplying this year's unit cost by next year's accession requirement. The unit cost can be adjusted to recover prior year losses or return of prior year gains. The goal of the unit cost concept is to relate all support activity costs to an output.

Unit costing at USAREC provides financial information which is used by the leaders of particular agencies like DoD, the Office of Management and Budget (OMB) , and Congress in order to:

1. Facilitate efficient management by creating an incentive for managers to minimize costs;
2. Provide standardized performance measures;
3. Support budget requests;
4. Provide improved decision making at the OSD level to better allocate scarce resources;
5. Report (in financial terms) the status and results of USAREC's activities.

Figure 7 shows the actual and projected unit cost per accession for USAREC's Reserve recruiting mission. The unit cost represents the average cost for one Reserve applicant to take the enlistment oath. The inputs include all expenditures needed to support the Reserve recruiting effort. However, the costs are spread across the various types of dissimilar outputs. For instance, the unit cost of recruiting a high quality soldier is equivalent to the unit cost of recruiting a low quality soldier. Likewise, a PS soldier's unit cost is the same as an NPS soldier's unit cost. Subsequent sections will examine the various cost inputs and outputs to better understand the unit cost performance measure used at USAREC.

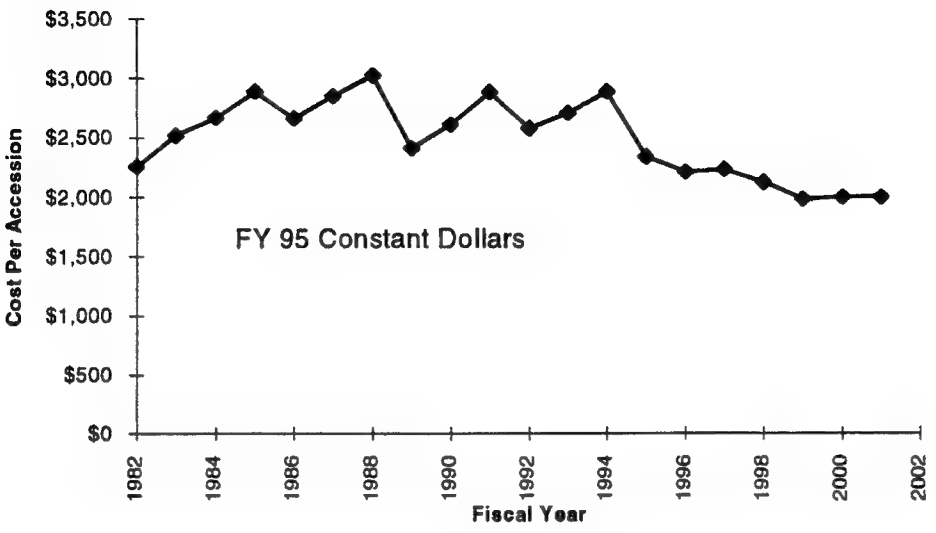


Figure 7: Gross Actual and Projected Cost Per Accession in FY 95 Constant Dollars. (Source: USAREC)
Note: FY 82 to 93 are actual figures. FY 94 -2001 are projected figures.

## C. COST INPUTS - EXPENDITURES

The inputs to unit cost resourcing at USAREC are the sum of all expenditures that support the recruiting effort. These expenditures are tracked by account and reported in a document known as the "Big Ten" report (see Appendix B, Table B-1). There is a separate Big Ten report to track both the Active and Reserve recruiting expenditures. USAREC's budget is imbedded in the Big Ten accounts and consists of the Operations and Maintenance, Army Reserve (OMAR) and Operations and Maintenance, Army (OMA) funds. OMAR and OMA operating funds are the only funds directly managed by USAREC. All other Big Ten accounts represent expenditures that support recruiting but are controlled by other agencies. They are added to the Big Ten report for unit cost calculations only. For instance, the Reserve Personnel Army (RPA) account represents USAREC's Reserve military payroll. The RPA funds are controlled by the USAR but allocated to USAREC for unit cost purposes. The sum of the Big Ten accounts serve as the numerator in the unit cost equation.

Trends and projections of USAREC's funds to support the Reserve recruiting mission are shown in Figure 8. Since the high point in 1985 of $197.2 million to the budgeted amount of $115.4 million in 1994, real spending power has declined by 41.5 percent (using constant 1995 dollars). The number of accessions for the Reserves has decreased at about the same rate, resulting in a relatively stable unit cost to date. In the future, accessions are expected to increase to a steady state of about 50,000 while expenditures are expected to stabilize at about $103 million. This combination will result in a slight decrease in unit cost as shown in Figure 7 on page 27.

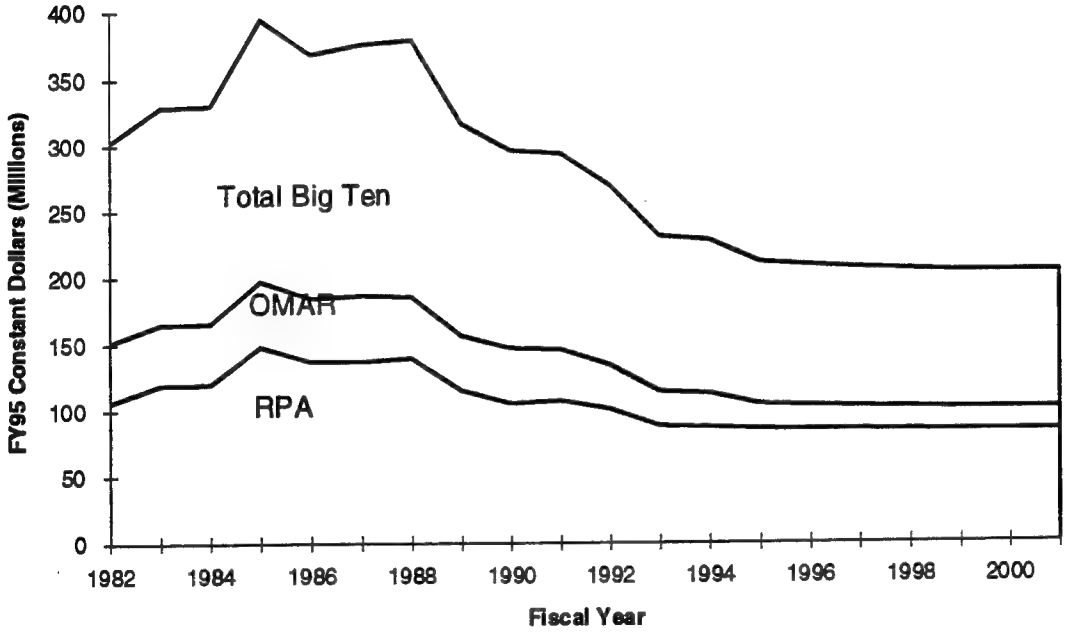


Figure 8: Army Reserve Recruiting Total Actual and Projected Expenditures. (Source: USAREC)
Note: FY 82-93 are actual figures. FY 94-2001 are projected figures.

The USAREC Reserve budget for FY 1994 is shown in Figure 9. The following sections will discuss how the major appropriations and sub-accounts are derived and how they affect the unit cost calculation.

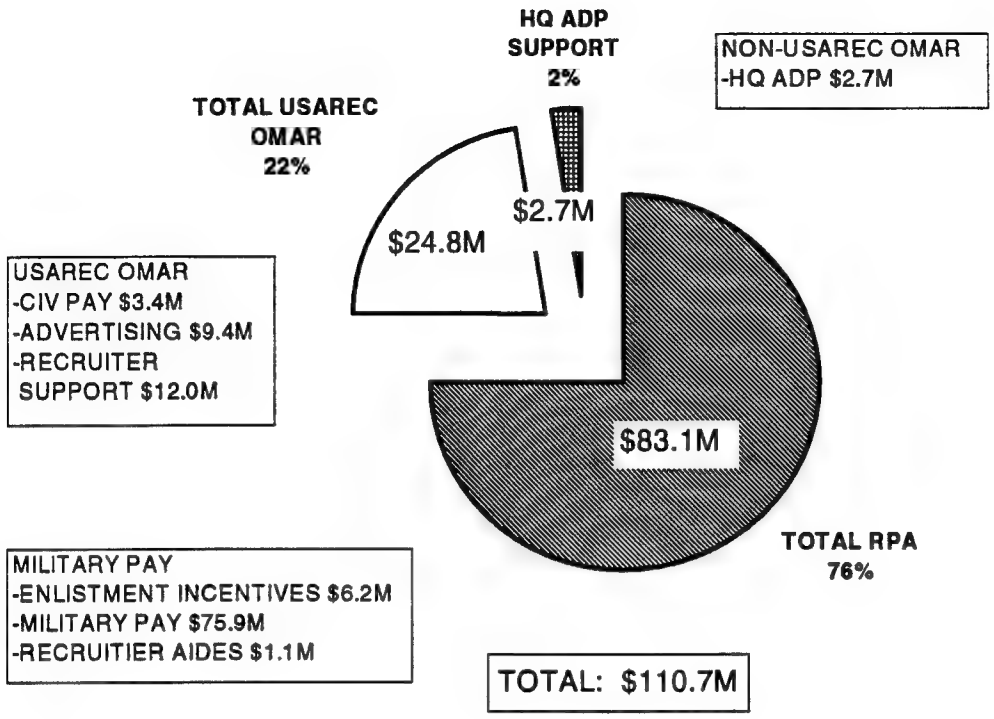


Figure 9: FY 94 USAR Recruiting Resources. (Source: USAREC)

### 1. The Reserve Personnel Army Accounts

The Reserve Personnel Army (RPA) expenditures account for 76 percent of FY 94 total recruiting expenditures. These expenditures consist of three sub-accounts: enlistment incentives, military pay, and recruiter aides.

(1) Enlistment Incentives. At $6.2 million for FY 94, enlistment incentive payments amount to about six percent of the total Reserve recruiting effort and are projected to remain at this level in the future. The Army Reserve offers enlistment bonuses for high quality NPS recruits enlisting in critical occupational specialties. To receive a bonus, an individual must enlist for eight years in the Ready Reserve, at least six of which must be in the Selected Reserve. The purpose of this incentive is to attract potential recruits for critical occupational specialties or high priority units to enhance Reserve manpower readiness. Bonuses change continuously based on requirements. The

USAREC RPA account only pays for the initial year's payment of the enlistment incentive. Anniversary payments of incentives are paid by other agencies.

Enlistment incentives funds are not managed by USAREC. The cumulative first year payment of incentives for NPS recruits is entered in the Big Ten report for unit cost purposes only. USAREC has no control over these funds. The Office of the Deputy Chief of Staff for Personnel determines policy on enlistment incentives based on input from other Reserve agencies. USAREC merely provides input on the effectiveness of incentives from their standpoint.

(2) Military Pay. By far the largest expenditure of the USAREC Reserve accounts, military pay represents 76 percent of FY 94 total Reserve recruiting expenditures. It is expected to remain at about this level in future years plans. This account includes money for pay and allowances of all Reserve military personnel on Active Guard Reserve (AGR) status in USAREC. The computation of military pay is based on military personnel *authorizations* times military pay composite pay rates. The composite pay rates are updated annually with one figure for enlisted and one for officers. For example, the military pay computation for the FY 94 Big Ten report is 85 officers times $77,394 plus 1,659 enlisted times $42,621. The composite pay rate assumes the average officer is in the pay grade of O4 with 16 years of service and the average enlisted soldier is in the pay grade of E-7 with 12 years of service. The composite rate includes base pay, retirement accrual, housing allowance, etc. The sum of the officer and enlisted pay is used by USAREC in the unit cost per accession determination. The composite rates underestimate USAREC's military pay since USAREC has more senior officers and enlisted personnel than the average unit.

Since military pay costs are based on personnel authorizations and not actual strength, the unit cost per accession does not consider unfilled positions or excess personnel. Therefore, changes in actual military personnel strength levels have no impact on the unit cost per accession. Only revisions in the authorized strength will change the unit cost. Thus, USAREC has no incentive to increase productivity by recruiting more

with fewer people since it will not affect their unit cost. Likewise, if their accession mission decreases, they have no control over military pay expenditures, which account for most of their costs. This situation alone leaves USAREC with little control over their unit cost per accession.

(3) Recruiter Aides. At $1.1 million for FY 94 this expenditure accounts for less than one percent of total expenditures. These funds provide for the pay and allowances, travel, and per diem of USAR officers and enlisted personnel on short tours of special training to support recruiting efforts. This money is spent when a recruiter makes a request for support for an event or for general assistance. The request for assistance goes through the recruiter's chain of command to the Army Reserve Command for approval. These expenditures are allocated to USAREC for unit cost calculations only. USAREC does not control the money in this account.

**2. The Operations and Maintenance Army Reserve Accounts**

The Operations and Maintenance Army Reserve (OMAR) accounts are under the direct control of USAREC. These expenditures represent approximately 22 percent of total spending. The OMAR accounts include civilian pay, advertising, recruiter support, and automated data processing support. The OMAR appropriation provides the wherewithal to carry on the day-to-day operations of the command. USAREC has the discretion to reprogram money from one account to another within the OMAR appropriation and make cuts as needed.

When USAREC is required to reduce their operating budget, they are forced to make cuts in the OMAR accounts since these are the only expenditures they control. According to USAREC resource management people, advertising funds are often cut first because they have the least short term impact on operations. USAREC does not feel that they can deny the command the basic assets they need to conduct day-to-day recruiting operations. Thus, when cuts are required, advertising funds are often a target.

However, OMAR expenditures do not provide an accurate picture of spending. A portion of Active component Operations Maintenance Army (OMA) funds spent on

Reserve recruiting are not allocated to the Reserve expenditure accounts because they are difficult to quantify. Some examples include facilities rent, indirect benefits of Active Army advertising, copier and other equipment used at the recruiting stations, supplies used, printing expenses, telephone bills, and some automated data processing services. A USAREC study found the expenses attributable to the Reserve recruiting mission but paid for by the Active recruiting funds to be about three percent of the total Active expenditures [Ref. 16]. This amount would have increased the FY 93 Reserve unit cost per accession by about 13 percent. This significant accounting problem makes the unit cost figures understated and deceptive as a measure of true unit cost per accession.

The subdivisions of the OMAR appropriation are discussed below -- civilian pay, advertising, recruiter support, and automated data processing support. By understanding the composition of these accounts and USAREC's control over expenditures, one can better understand the limitations of using unit cost as a performance indicator.

(1) Civilian Pay. At $3.4 million for FY 94, civilian pay amounts to about three percent of the total Reserve recruiting expenditures. Civilian pay expenditures are expected to decline only slightly in future years. Although there are civilian hiring strategies which can enhance efficiency, there are difficulties associated with releasing civilians to cut costs. Congress has mandated stringent procedures Federal agencies must follow when cutting employees. When civilians working for USAREC are released, USAREC incurs short run costs associated with compensation payments. These procedures dampen the cost savings and expedience of reducing costs by cutting civilian employees.

(2) Advertising. USAREC uses advertising as a tool to increase a prospective applicant's propensity to enlist. Their current efforts are directed at making recruiting more cost-effective by creating a public conviction that Army service leads to civilian success [Ref. 14]. At $9.4 million in FY 94, advertising represents nine percent of the total Reserve recruiting expenditures. However, the advertising budget is expected to decline to just four percent of expenditures by 2001 (in constant FY 95 dollars).

Advertising effectiveness is difficult to measure in the military recruiting environment. In free market conditions, planners can often find a relationship between advertising and demand for their product. However, in the recruiting environment, the number of accessions is given and does not allow for a free market study of the effects of advertising on accessions. Because the effectiveness of advertising is not supported by strong empirical evidence, advertising funds are easier to cut during times of budget reductions.

Nevertheless, USAREC understands the importance of advertising. They cite a 1989 RAND study entitled *Recruiting Effects of Army Advertising* in a 1993 command briefing. The RAND findings include:

1. Estimates that the marginal cost of recruiting a high quality person through increased advertising to be between $5,000 and $6000. The marginal cost of achieving the same goal by increasing the recruiting staff was about $5,700, and the cost of using cash bonuses was much higher (about $16,000 per recruit);
2. Expansion of Army advertising during a given month can induce increases in high quality contracts for as long as six months.
3. Effectiveness of a given month of advertising falls 43 percent each month after it occurs;
4. Advertising has a significant effect on high-quality enlistments. [Ref. 14]

(3) Recruiter Support. At $12 million for FY 94, recruiter support represents about 11 percent of total expenditures and is expected to decline only slightly in future years. Recruiter support funds support the day-to-day operations of the recruiter stations. These activities include recruiter training; vehicles; mission travel; advertising postage; meals, lodging, and travel to process applicants; etc. Meals, lodging and travel expenses for applicants are the only variable costs directly attributable to accessions. USAREC has control over recruiter support expenses but is reluctant to make short term cuts. Cutting these funds would not allow recruiters to do their daily missions in their current configuration.

(4) Automated Data Processing (ADP) Support. This account supports the Keystone computer link between USAREC and the Training and Doctrine Command

(TRADOC). At $2.7 million for FY 94, the ADP support account represents only two percent of total expenditures and is expected to remain at this level in future years. The account pays for the Reserve's portion of the computer link with TRADOC. This link provides data concerning available training seats for recruits at various Army training activities. The ADP support account is not controlled by USAREC. This expenditure is added to the Big Ten report for purposes of unit cost calculations only.

The unit cost resourcing approach assumes that the expenditures described above are variable with the number of accessions. Clearly, many of USAREC's costs are fixed and do not change with the accession mission. The correlation table below (Table 2) shows the degree of linear relationship between the various recruiting accounts, the number of recruiters on production, and the number of accessions (using actual figures from FY 82-93). The correlation coefficient of .8 at the intersection of total recruiting costs and accessions suggests a fairly strong linear relationship. Likewise, there is a fairly strong linear relationship between advertising expenditures and accessions. On the other hand, there is a curiously weak linear relationship between recruiters and accessions and between enlistment bonus expenditures and accessions. Still, these results should be interpreted with caution as they do not mean there is a cause-and-effect relationship. USAREC should examine these relationships to determine the underlying causes. For instance, the weak relationship between recruiters and accessions might be explained by the significant increase in the quality of accessions during the FY 82-93 time frame. If quality recruits take more effort to access, recruiter productivity would be expected to go down. Therefore, the lack of a linear relationship between recruiters and accessions can be explained by the improvement in quality content.

This section provided a brief description of the expenditures affecting the cost per Reserve accession. This analysis uncovers several limitations of using unit cost as a performance measure. First, USAREC only has discretion over about 25 percent of their spending. Second, about three percent of the total Active expenditures are spent on Reserve soldier recruiting. This amount is not applied to the Reserve recruiting unit cost

| | Enl Incentives | Mil Pay | Recr Aides | Civ Pay | Adv | Recr Spt | Tot Cost | Recrtrs | Accns |
|---|---|---|---|---|---|---|---|---|---|
| Enl. Incentives | 1.0 | | | | | | | | |
| Mil Pay | 0.5 | 1.0 | | | | | | | |
| Recr Aides | 0.4 | 0.8 | 1.0 | | | | | | |
| Civ Pay | 0.2 | 0.3 | 0.2 | 1.0 | | | | | |
| Adv | 0.7 | 0.8 | 0.8 | 0.4 | 1.0 | | | | |
| Recr Spt | 0.2 | 0.6 | 0.5 | -0.4 | 0.4 | 1.0 | | | |
| Tot Cost | 0.8 | 0.9 | 0.8 | 0.3 | 0.9 | 0.6 | 1.0 | | |
| Recruiters | 0.2 | 0.7 | 0.7 | -0.4 | 0.5 | 0.9 | 0.6 | 1.0 | |
| Accessions | 0.5 | 0.8 | 0.7 | 0.6 | 0.8 | 0.4 | 0.8 | 0.3 | 1.0 |

Table 2: Correlation Coefficients for USAR Recruiting Expenditures, Recruiters, and Accessions. Note: Using actual figures from FY 82-93. (Source: USAREC)

calculation resulting in an unrealistically low unit cost per Reserve accession (about 13 percent lower than it should be). Third, almost all of the expenditures are fixed costs. This fact coupled with the limited control over expenditures affords USAREC very little control over cost per accession. Thus, the unit cost per accession is a very deceptive and unrealistic performance indicator. Fourth, the expenditures are spread over dissimilar outputs making the unit cost per accession the same for different categories of recruits. In reality, NPS accessions cost more to access than their PS counterparts, and high quality accessions take more effort to assess than their low quality counterparts. The unit cost does not consider these differences; therefore, limiting its use as a tool for resource allocation. An analysis of the denominator of the unit cost equation, accessions, will further understanding of the limitations of the unit cost resourcing approach.

## D. OUTPUTS - ACCESSIONS

Accessions are a function of force requirements outlined in the National Military Strategy Document and Defense Planning Guidance. Headquarters, Department of the

Army (HQDA) and the Office of the Chief of Staff, Army Reserves (OCAR) assign annual and by-month accession missions to USAREC based on force requirements. They use an algorithm which factors in current force strength and projected attrition to determine the accession mission. HQDA's guidance to USAREC includes quality targets for NPS applicants established in the form of a minimum percent of high school graduates (HSDG), a minimum percent of high aptitude applicants (TSC I-IIIA), and a maximum percent of low aptitude applicants (TSC IV). Their guidance also includes the number of training seats available by month and the NPS/PS mix. Since accessions are not driven by the market, USAREC must accept manpower requirements as given. The number of accessions achieved serves as the denominator in the unit cost equation.

Due to the Army downsizing in recent years, the number of required accessions has declined (see Figure 5 on page 13). The drop in accessions over time is not indicative of a failure by USAREC to accomplish HQDA assigned missions but the result of decreased requirements predicated by the draw down of the USAR structure. However, the Army projects the number of accessions to reach a higher steady state of approximately 50,000 per year by the end of the 1990s. With the number of accessions rebounding and the projected budget declining, USAREC can expect a lower unit cost per accession in the future. Whether or not they will be able to meet the quality requirements is another issue.

A major problem with the unit cost model for determining USAREC's Reserve recruiting performance is that it does not adjust for quality. While it is generally understood that it costs more to recruit high quality personnel than low quality personnel, there is no mechanism to adjust the unit cost for quality content. In 1980 the quality content for NPS soldiers recruited was 51 percent high school degree graduates (HSDG) and 48 percent category IV personnel. Since then, the quality content has increased dramatically to 95 percent HSDG, 74 percent category I-IIIA, and only two percent category IV personnel for 1993. USAREC has been fortunate to have a decreasing

accession mission commensurate with a requirement to produce higher quality. The higher quality goals of HQDA have had a negative impact on recruiter productivity.

Figure 10 below shows the relationship between recruiter productivity and the quality content of accessions from 1982 to 1993. While recruiter productivity (accessions divided by number of recruiters) has declined, quality content has increased. Recruiter productivity is a complicated function involving recruiter efficiency and propensity of youth to enlist. USAREC estimates that it often takes a recruiter approximately 200 contacts, 19 scheduled appointments, and 14.2 actual appointments that results in testing 3.7 recruits with only 1.7 quality male graduates fully qualified to access [Ref. 12, p. 18]. This estimate equates to about 18.2 hours of work for each quality accession. Low quality recruits are estimated by USAREC to take about one tenth of this effort. The added effort to access a quality recruit as least partially explains the relationship in Figure 10. Thus, for recruiters to maintain quality content with an increasing accession mission, they will have to either improve efficiency, or market propensity will have to improve.

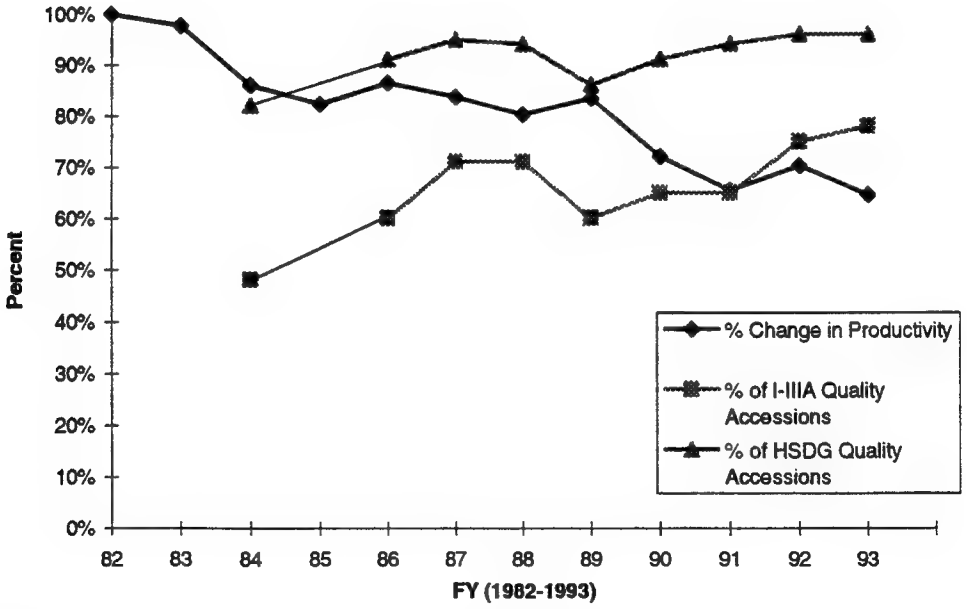


Figure 10: Recruiter Productivity Compared with Quality Content. (Source: USAREC)

If USAREC was allowed to adjust unit cost for quality content, the unit cost per accession would be even less than it is now. Figures 11 and 12 below present a quality adjusted unit cost for NPS Reserve accessions. If you assume low quality NPS soldiers and PS soldiers are free, you can calculate the unit cost for high quality NPS accessions.[6] Figures 11 and 12 illustrate that the quality adjusted unit cost has been decreasing since 1982. This cost cannot be compared with the non-adjusted unit cost, but it can be used to illustrate that as quality improves, the unit cost will decrease if inputs and outputs remain the same. If USAREC's performance is going to be measured by unit cost, and quality soldiers cost more to recruit, the unit cost calculation should be adjusted for quality achieved.

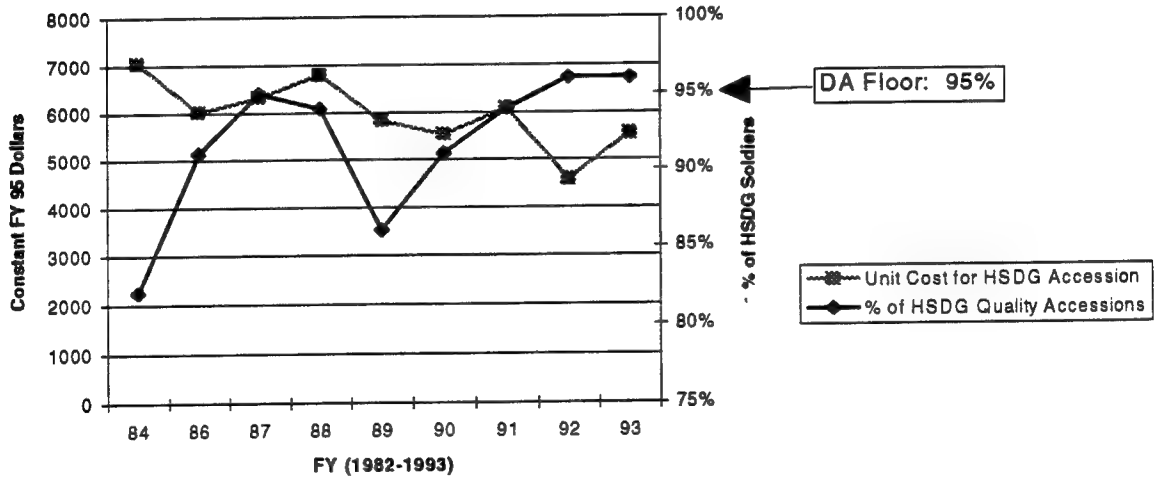


Figure 11: Quality Unit Cost (QUC) in Terms of Percent High School Graduation (HSDG) Accessions.

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[6] Quality content for Reserve accessions is only tracked for NPS soldiers. USAREC does not track the quality content of PS soldiers since they predict their potential based on their prior performance while on Active duty in the Regular Army.

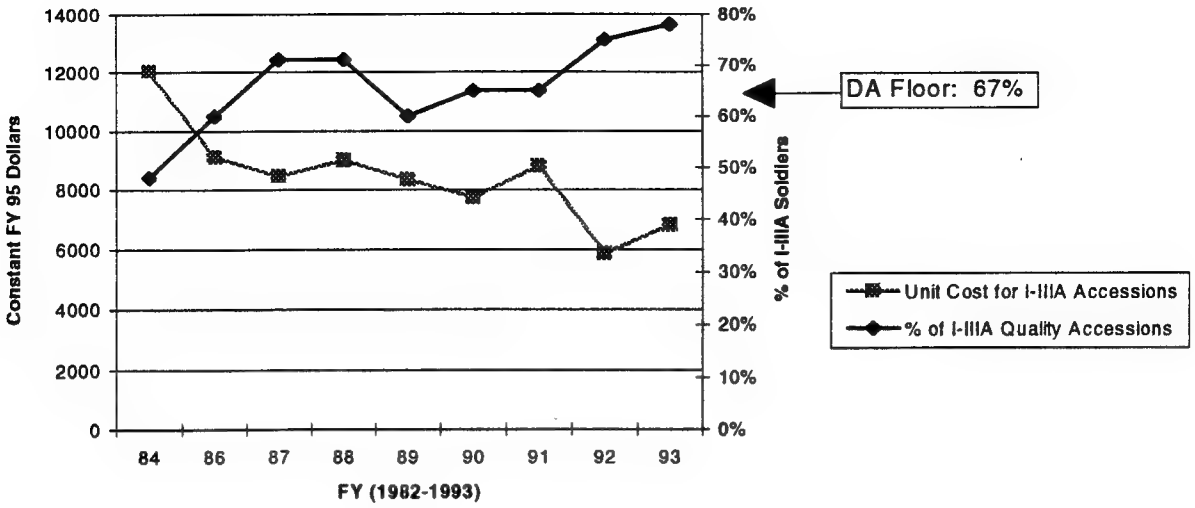


Figure 12: Quality Unit Cost (QUC) in Terms of Percent Category I-IIIA Accessions.

This section provided an overview and analysis of the outputs of the USAREC Reserve unit cost model. In summary, USAREC does not have control over their accession mission. This mission is determined by HQDA along with quality content and NPS to PS mix. USAREC must satisfy all demand (accessions) at the established unit cost. This mission is especially difficult as they try to meet HQDA quality goals. Recruiter productivity seems to be declining as quality goals increase. Unit cost should account for quality to give USAREC credit for the improved quality content of their recruits since quality is costlier and harder to achieve. USAREC faces a dilemma in the future as they struggle to maintain quality content while meeting an increased accession mission. For USAREC to meet their future demand, recruiters must become more efficient, or propensity to enlist must improve. USAREC is currently sponsoring research in the area of recruiter incentives to improve productivity. If prudent, USAREC may replace their current quota system of assigning accession missions and evaluating performance with a more productive incentive scheme.

## E. LIMITATIONS OF UNIT COSTING

The above analysis uncovers several limitations of using unit cost as a management tool and performance indicator at USAREC. This section will discuss the use of unit costing as an incentive to minimize costs, as a tool to report the status and performance (in financial terms) of USAREC's activities, and as a tool for budget allocation.

### 1. Lack of Incentives to Make Efficient Cuts

One of the objectives of unit costing was to facilitate efficient management by creating an incentive for managers to minimize costs. USAREC would be motivated to reduce costs if the benefits of doing so exceeded the penalties. There are two major reasons why USAREC is not motivated to reduce unit cost as intended. First, the leadership at USAREC knows that if they reduce their costs in the short run, their future budget allocations will be reduced accordingly [Ref. 17, p. 9]. Second, since they do not control most of their expenditures (i.e., military pay), cost reduction efforts will not be reflected in their unit cost. In fact, if the repercussions of a higher unit cost are small, USAREC leadership may pursue policies which are counteractive to cost reduction and economic efficiency.

Because of the unit cost structure, actions to reduce costs this period make it harder to achieve accession requirements in the future. HQDA expects producers to break-even each year, given their expected output. The budget for the next year is determined by multiplying this year's unit cost goal by next year's total expected work load. If USAREC reduced costs this year, their budget would be cut the following year so that they break-even (accessions remaining constant). Reduced funding may make it even more difficult to meet accession demand and quality goals in an environment where the propensity to enlist is constantly shifting. For this reason, USAREC leaders may be reluctant to reduce operating costs.

Even if USAREC was motivated to reduce operating costs, they have little control over their expenditures. This situation has the potential to create both incentive and

efficiency problems. For example, military pay constitutes 69 percent of USAREC recruiting expenditures (in the numerator of their unit cost equation). Any efforts to reduce costs by cutting military manpower will not be reflected in the unit cost equation. Military pay expenditures are based on USAREC's *authorized* strength and not their actual strength. There is no incentive to operate with fewer personnel since they will still be charged for their authorized strength. In fact, USAREC will be tempted to carry excess personnel as a buffer for future increased workloads.

Since USAREC only controls 22 percent of their Reserve recruiting expenditures (the OMAR appropriation), any cost saving measures implemented are overshadowed by the remaining 78 percent of recruiting expenditures which they do not control. The penalties of reducing expenditures are likely to be greater than the benefits.

As mentioned earlier, the OMAR accounts suffer the greatest budget cuts. Since they are the only accounts under USAREC's control, they are the most accessible. The advertising budget usually is cut first to spare the funds needed for daily operation and avoid the difficulties with releasing civilians. Faced with budget reductions, as is often the case, USAREC cuts advertising dollars. By cutting what is readily available and not what is inefficient may lead to gross overall inefficiencies. [Ref. 12, p. 42]

In summary, although the DoD unit costing initiative was designed to improve efficiency by providing incentives for managers to cut costs, it may have the opposite effects. At USAREC, improving cost efficiency will lead to reduced funding in the future. In fact, with little control over expenditures, USAREC may be tempted to pad personnel numbers. When cuts are inevitable, they are forced to make cuts in the only areas they control. These cuts may not be efficient.

### 2. Data Accuracy

Another intended objective of unit costing is to report the status and performance of activities in financial terms. This goal requires that all costs are identified and allocated to the outputs. In this manner, unit cost can be used as a resource tool to support and evaluate a service activity's performance. Congress and HQDA use the unit cost figure to

make resource allocation decisions. However, unit costing at USAREC has deficiencies that hinder this purpose due to data accuracy. The analysis above uncovered numerous reasons why the unit cost figure is misleading. First, the method used by HQDA to calculate military manpower pay does not reflect true manpower costs. Second, OMAR expenditures do not reflect the significant contributions from the Active OMA appropriation. And third, the Reserve unit cost figure is not adjusted for quality. All of these limitations impede leaders from effectively allocating resources due to inaccurate data.

If decision makers are expected to choose between competing alternatives using unit cost as a decision criterion, they must use true costs in calculating unit cost. Calculating military pay, which is 69 percent of total costs for FY 94, using authorized personnel numbers instead of actual personnel on hand, will understate or overstate true costs. Furthermore, using composite rates, one rate for enlisted personnel and one rate for officers, understates the military pay recruiting expenditures for USAREC. USAREC possesses a rank structure that is much more senior in grade compared with an average Army unit. A previous study on the use of composite rates at USAREC for the Active recruiting mission estimates that military pay expenditures are understated by approximately 20 percent [Ref. 12, p. 42]. These methods cause major distortions in the unit cost figure because of the relative size of the military pay account.

Because there are Reserve recruiting expenditures paid by Active recruiting funds, the Reserve unit cost is understated and the Active unit cost is overstated. As mentioned earlier, a USAREC study found the expenses attributable to the Reserve recruiting mission but paid for by the Active recruiting funds to be about three percent of the total Active expenditures. This amount would have increased the FY 93 Reserve unit cost per accession by about 13 percent. This significant accounting problem makes the unit cost figures deceptive. If HQDA and Congress use these unit costs when making decisions on the composition of the Total Force, they may inefficiently allocate resources.

Finally, if decision makers want to make cost effective decisions based on unit cost, they need to adjust the unit cost for quality content. Quality of accessions is a major consideration in allocating resources to USAREC. Since quality personnel generally cost more to recruit, the use of a quality adjusted unit cost would give a more accurate picture of USAREC's efficiency. Failure to account for quality could result in a verdict of reduced efficiency at USAREC. This distorted view of USAREC's efficiency could lead to inefficient policies and funding.

### 3. Resource Allocation Using Unit Cost

This section examines whether unit costing encourages DoD to maximize the value of scarce resources through efficient allocation of funds. From DoD's perspective, efficiency requires that managers choose investments that have greater benefits than costs. The benefit is the increase in surplus value generated over the life of the investment discounted to its present value. USAREC's unit cost merely provides a "snapshot" of cost per accession. It does not consider the life cycle cost of that investment. For instance, high quality soldiers may have a lower life cycle cost than low quality soldiers, but since they generally cost more to recruit, they have a higher unit cost. A higher unit cost may cause Congress to push for lower quality recruits to reduce expenditures when they are really more expensive in the long run. Life cycle costs must be considered to minimize costs and efficiently allocate resources.

Economic efficiency in allocating resources requires not only cost minimization over the life of investments (technical efficiency), but also that marginal benefit (MB) equal marginal cost (MC). The DoD unit costing approach adopts a constant marginal cost assumption and equates average and marginal cost. DoD unit costing implicitly assumes that all costs are variable with accessions. The above analysis of cost inputs found that many of the expenditures associated with recruiting are fixed. As a result, DoD ignores the real possibility of divergence between marginal and unit cost. Thus, the use of unit cost will not achieve the intended efficiency. [Ref. 17]

As mentioned above, economic efficiency requires not only that MB equal MC, but also that costs are minimized. However, the incentives for USAREC to cut costs may be weak. If USAREC does not pursue and achieve cost minimization, they cannot achieve economic efficiency [Ref. 17, p. 12]. If unit costing at USAREC does not achieve economic efficiency nor technical efficiency, it will not maximize DoD's scarce resources. This condition results from using unit costs instead of marginal costs and using misplaced incentives to minimize costs. Furthermore, the life cycle cost of investments should be considered in the marginal cost analysis. Unit cost does not consider life cycle costs. If unit costing achieves economic efficiency and good allocation of resources, it is purely coincidental.

## F. CONCLUSIONS

To summarize, this chapter has described USAREC's unit costing scheme. Unit costing has some important goals -- to provide new and potentially important information to focus management attention on costs. However, in recruiting, unit cost falls short of providing management with the necessary information to allocate resources efficiently as intended. Unit cost figures are deceptive and do not induce the proper incentives to cut spending. For these reasons, unit cost figures should not be used for making resource decisions nor cost comparisons.

A fundamental problem with unit costing at USAREC is that USAREC does not have adequate control over its outcome. They only control 22 percent of inputs and have no control over the quantity and quality of outputs demanded. The output does not consider the quality content of the recruits. Thus, they have very little control over the unit cost per accession. Furthermore, the data that is used to calculate unit cost is deceptive because it does not consider quality, true military manpower costs, nor misplaced OMA costs. Unit costing as envisioned by DoD was to provide a standardized performance measure and to improve decision making. How can USAREC be judged on something they cannot control, and how can they be judged on a figure derived from inaccurate data? This approach violates major principles of management science and

provides confusing incentives. In order for a service activity to allocate resources efficiently, it must be given performance measures that induce efficiency and the ability to control them.

Unit cost is just a snap shot in time. It does not provide decision makers the information they need to achieve economic efficiency in the long run. Only marginal costs that consider life cycle expenditures would induce economic efficiency. Thus, marginal life cycle cost should be used to set unit cost goals and to evaluate various recruiting policy options. In this manner, decision makers would realize the true cost impact of their decisions and make more cost-effective decisions.

The determination of the most cost-effective accession policies has been a strategic issue debated by Congress and the services since the advent of the all-volunteer force in 1973. In order to satisfy Congress's demands, the services are pressed to develop a analytical approach that links accession policies to mission performance and personnel costs. In the next chapter, we introduce a life cycle cost-effectiveness methodology for evaluating Army Reserve accession policies.

# IV. LIFE CYCLE COST ANALYSIS

> If you sit down and try to follow all the little bouncing balls [molecules] in a gas, you can't. But you can draw some gross conclusions from an understanding of the overall system that are extremely simple and tell you a lot about it. (Governor John Sununu drawing on his training in mechanical engineering.)

## A. INTRODUCTION

### 1. History of the Problem

The Armed Forces are under increasing pressure from Congress as the agent of the taxpayers to justify their costs and seek cost-efficient policies. USAREC and the USAR are no exceptions. The new world order and the expected peace dividend have intensified the effort to reduce military spending. Thus, they are in need of tools to help achieve economic efficiency while ensuring the Army and Army Reserve meet the challenge of defending the nation's interests.

Congress has always been interested in the quality of personnel in the Armed Forces since the abolishment of the draft in 1973. Interest grew out of the misnorming of the ASVAB in 1980 which resulted in a much poorer quality mix than both Congress and the Services had wanted. Congress demonstrated their concern with legislation in 1981 establishing ceilings on the number of low quality recruits. Through the 1980s the question continually arose in Congress: How much quality is enough? [Ref. 5, p. 101]

The Services responded to this question with policies that suggested "more is better." As recruit quality achieved each year exceeded targets, the Services' correspondingly increased their targets to match the previous years results. For instance, when Congress required the Services to report their quality requirements in 1985 for the five year period from 1985 to 1989, DoD basically reflected the recruiting results for 1984 [Ref. 9, p. 34]. DoD and the Services were unable to establish clear relationships between job performance requirements and recruit quality needed. With the recruit quality at the

highest levels in history, Congress now asks the Services: Why do we need so much quality and why should we spend so much money to attain it?

Research to answer this question has not been at a standstill. Several cost-performance models are under development to assist personnel planners in setting and justifying quality levels to meet the needs of the Services. In fact, Congress appropriated money in the Defense Appropriations Bill for FY 83 to conduct research in linking recruit quality to job performance and costs. The Committee on Enlistment Standards of the National Research Council won the contract and has been working on the Joint-Service Job Performance Measurement/Enlistment (JPM) Standards Project for more than a decade.

### 2. The JPM Project

The initial purpose of the JPM project was to develop procedures that provide the Services a more scientific basis for establishing their standards. Their first step was to develop hands on performance tests to establish and validate a link between hands on performance and the ASVAB. In the past three years, the project has focused on the development of a cost-performance trade-off model to be used by military manpower planners in making decisions about recruit quality goals. To satisfy Congress, DoD needs to be able to balance performance gains attributable to selecting high quality with the costs of recruiting, training, and retaining high quality personnel. Dr. W. S. Sellman of the Office of the Assistant Secretary of Defense, Director for Accession Policy, summed up DoD's problem:

> Once we had the models, if Congress said, what happens if we cut your budget by 10 percent, we could respond, quality would go down by $x$ percent and performance would go down by $y$ percent. [Before this] we could not answer. [Ref. 5, p. 4]

The JPM cost-performance trade-off model is a complex model which takes specifications for required performance levels for each different job, determines a recruit quality mix that will yield the desired performance levels, and predicts the recruiting costs

required to obtain this mix of recruit quality. Figure 13 is a pictorial view of the empirical linkages which the JPM model establishes to provide the quantitative measures of the trade-off that are necessary for policy decisions.

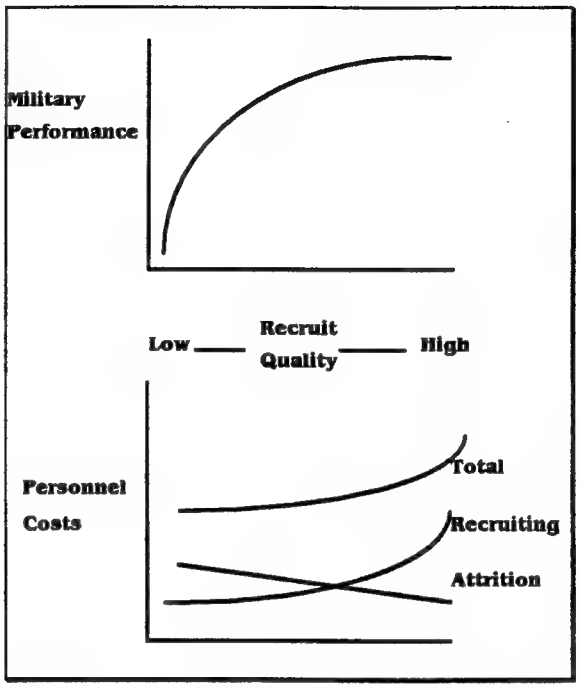


Figure 13: Accession Quality Cost-Performance Trade-Off. From Ref. [5].

The Systems Research and Applications (SRA) Corporation and the Human Resources Research Organization (HumRRO) jointly developed a microcomputer model for the Assistant Secretary of Defense (Personnel and Readiness) based on the JPM project research. The model uses a constrained minimization problem solving approach with three elements: accessions by recruit quality category and occupation (which define the variables to solve for), performance and personnel strength goals (which define the constraints), and personnel costs (which comprise the objective function) [Ref. 5, p. 107].

The JPM model uses a non-linear quadratic programming method to calculate the minimum personnel cost solution while meeting performance goals. Some of its features include consideration of personnel attrition for first term enlistment (defined as four years), consideration of the effect of unemployment on recruiting costs, and adjustment

for the variable average cost nature of recruiting. While not without flaws, the model, by quantifying the potential trade-off between performance and cost, should be useful compared to the current process of determining accession quality goals.

### 3. Limitations of the JPM Model

One of the major problems with a complex model that has far reaching implications, such as the JPM model, is validation. Validation requires reaching an acceptable level of confidence that the inferences drawn from the model are correct and applicable to the real-world system being represented. Validation also requires evidence that the rationale behind the approach will produce credible answers that can be used in the real world by the ultimate decision makers. For the JPM model, validation requires gaining the trust of DoD and its agencies that the model represents the real world and will give optimum results while meeting DoD's personnel needs.

Currently the JPM model is not in wide use at DoD nor USAREC; although, it has been available to these agencies since 1993. Perhaps these agencies do not feel the results are realistic because some of the underlying empirical relationships or assumptions are not valid. Or, perhaps the relationships and results are accurate, but the users do not believe them because they do not understand how the model works. When the model builders conducted a validation exercise comparing FY 90 actual accessions versus model selection cohorts, the model was not so successful in replicating the quality levels in the occupation groups. The model builders acknowledged that inaccuracies in measuring either the quality-performance relationship or recruiting costs, both potential problems with the model, may have caused the discrepancies. Or the discrepancies could have been caused because the Services' processes for setting quality goals by occupation, which are not driven solely by performance and cost considerations, are not producing the cost-effective solution. [Ref. 5, p. 120] Either way, validation of the model will require a time consuming process of education, use, and refinement.

Some acknowledged limitations of the JPM model are outlined below:

1. The performance measures used reflect only the ability to perform selected tasks for each occupation at the entry level. The model ignores other dimensions of performance such as leadership potential;
2. The level of performance required by the user is still based on expert judgment and not analytical procedures;
3. The model does not account for the costs of disciplinary problems sometimes associated with lower quality soldiers;
4. The model directly measures the hands on performance for only 24 occupations across all four Services. These results are then used to predict performance for all occupations introducing sampling error;
5. It was impossible to measure task performance for many critical tasks, e.g., riot control for a military policeman;
6. The model does not link performance to military readiness. This is a future goal of the model.
7. The model only applies to the Active component.

Unfortunately, much of the data and methodologies available do not support the information needed by policy makers to make truly optimum accession policy decisions. Even if the data were available and accurate, performance is very difficult to quantify and measure. In effect, the JPM project pushes the usefulness of the data beyond accurate limits. Despite the limitations outlined above, the model in its current form provides an improvement over existing tools for analyzing recruiting and first-term performance issues. By forcing the Services to study the links between recruit characteristics, performance, costs, and readiness, Congress has at least caused policy makers to look closer at these important issues.

## B. LIFE CYCLE COST-EFFECTIVENESS METHODOLOGY

The previous chapter discussed the limitations of using unit cost to allocate resources. However unit cost does not consider the life cycle implications of manpower procurement. This chapter will view cost from a life cycle perspective. The life cycle cost-effectiveness approach developed here is meant to provide a useful tool and methodology to assist the decision maker.

The intent of this research is to develop a simple and flexible life cycle cost-effectiveness model to evaluate recruiting alternatives for the USAR Selected Reserve. To illustrate the use of the model, the analysis in this chapter compares the cost effectiveness of two NPS versus PS recruit policy alternatives and two NPS high quality versus low quality recruit policy alternatives. An accession policy is superior if, on the basis of life cycle cost analysis of competing alternatives, it is determined to have the lowest life cycle cost per man-year, in present value terms. By keeping the model simple, it is inherently understandable. The user can easily conduct a sensitivity analysis to determine the critical nature of the parameters. By making it flexible, the user can easily change parameters as more accurate data becomes available. The end result is an easily understandable model which addresses the economic issues of military manpower planning in terms of personnel life cycle.

### 1. Description of the Model

The model developed for this study uses a micro-computer spreadsheet program to determine the present value of periodic cash flows for specified enlisted recruit categories entering the USAR Selected Reserve. The basic approach begins with observing the behavior over time of several Selected Reserve entry cohorts to determine attrition rates and promotion rates for the various recruit categories under study, i.e., NPS versus PS and high quality NPS versus low quality NPS reservists. The model will include the effects of attrition and promotion when calculating life cycle costs. For instance, two entry cohorts are observed to determine the average attrition rate and promotion rate over a seven year period. The user specifies the recruiting policy in terms of size, quality level for NPS soldiers, and NPS versus PS mix. Using the attrition rates, the model determines the average inventory of manpower available each year and the end strength achieved at the end of seven years given the specified recruiting policy.

The next step in developing the model is to allocate recruiting, training, and compensation costs to the appropriate actions for each year in the projected life cycle of an entry cohort. The periodic costs will include the effects of promotions, inflation, and

discount factors. The model output includes the total life cycle cost and cost per man-year of the specified end strength and specified recruit mix. In the examination of alternatives, the analysis in this study looks at cost profiles, a break-even analysis, high cost contributors, and a sensitivity analysis to recommend a preferred approach. See Appendix B for an example of the model construction, inputs, and outputs. The following sections discuss this methodology in detail to include assumptions and limitations.

### 2. Recruit Categories

In selecting the alternative recruit mixes to analyze in this study, the choice is driven by the policy applications of the model. Generally, Reserve manpower policy planners need to choose and justify the mix of NPS versus PS accessions and high quality NPS versus low quality NPS accessions. The study does not differentiate PS accessions by quality level because PS reservists are ordinarily selected based on their prior Active component performance rather than their quality marks. For NPS applicants, AFQT scores and high school graduation status are the two characteristics used by DoD to establish recruiting goals and measure recruiting performance. For this study, high quality is defined as a solider with AFQT scores in the range of I-IIIA with a high school diploma or currently attending high school. Recruiters accessing high school students receive credit for a high quality accession under the assumption that these soldiers all finish high school. DoD and this study consider all other applicants as low quality. This study does not evaluate the life cycle cost-effectiveness of accessions based on gender or race. These characteristics are no longer overtly used to set accession goals. However, if the data were available, the user could study the cost-effectiveness of alternatives in that regard also.

### 3. Performance

This study will look at performance in two ways. First, the analysis will view performance as the life cycle cost per man-year for each recruit category. In this regard, the benefit to the Selected Reserve is strictly the man-years contributed by each soldier.

Second, the analysis will consider the life cycle cost per performance adjusted man-year for NPS soldiers using the hands-on performance test results from the JPM project. The model adjusts man-years contributed by each NPS soldier to reflect average effectiveness based on AFQT score and years of experience. For instance, a soldier with a higher aptitude or more experience usually performs better than his counterparts, all other factors being the same. Thus, the performance adjusted man-year accommodates these differences in performance. However, no similar performance data are available for PS soldiers. Thus, life cycle cost per man-year is the only performance measurement for evaluating alternative NPS to PS ratios.

In the JPM project, the researchers defined the relationships between AFQT, job experience, and hands-on performance tests for 30 jobs in all four services (first-term enlistees only) [Ref. 5, p. 20]. One can interpret the hands-on performance test scores as the percentage of the job that a recruit can perform successfully [Ref. 5, p. 58]. Figure 14 plots the mean hands-on performance test scores for the four aptitude groups at various job experience levels (see Appendix B, Table B-5 for scores by category).

The JPM results validate the researchers' hypothesis that hands-on performance test scores increase for examinees with more experience. The results also suggest that as service members in this study gain experience, initial ability remains important in determining hands-on job performance. [Ref. X, p. 2-7]

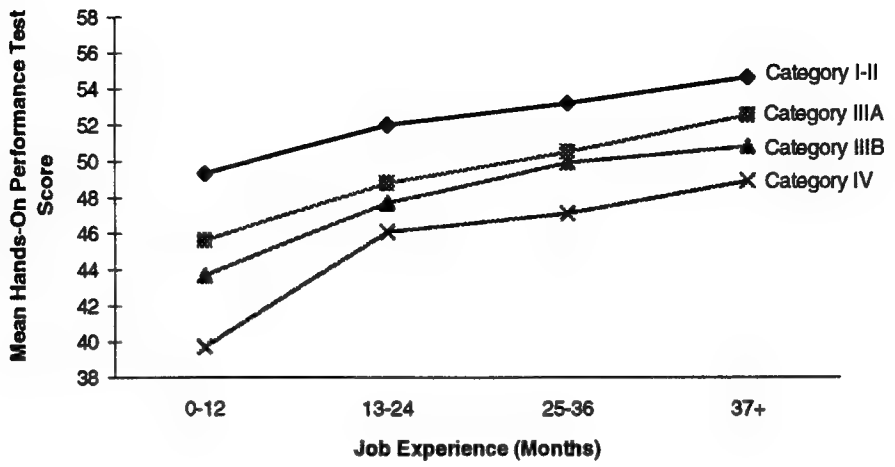


Figure 14: Mean Hands-On Performance Test Scores by Aptitude and Job Experience. From Ref. [5].

To make the JPM performance data useful for this analysis, the results are converted into performance-effectiveness factors as shown in Table 3. Since, the JPM data only provides results for four years of experience, the factors for years five, six and seven are estimated. One can interpret these factors as the effectiveness of performance contributed by a soldier compared to his or her counterparts with different AFQT scores or experience levels. For instance, assume that high aptitude soldiers with four or more years of service perform their duties better than their counterparts. This category of soldiers establishes the reference from which all other soldiers' performance is judged, and they have a performance-effectiveness factor of one. All soldiers with less experience or lower aptitudes usually perform their duties with a lower degree of effectiveness and have a performance-effectiveness factor less than one. The life cycle cost-effectiveness model multiplies the performance-effectiveness factors by the man-years contributed in a recruit category each year to determine a life cycle cost per performance-adjusted man-year value. See Appendix B, Table B-5 for the methodology used in calculating hands-on performance adjusted life cycle cost-effectiveness.

| | Years of Experience | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **High Quality (CAT I-II + IIIA)** | 0.886 | 0.941 | 0.968 | 1.000 | 1.000 | 1.000 | 1.000 |
| **Low Quality (CAT IIIB + IV)** | 0.779 | 0.876 | 0.906 | 0.931 | 0.931 | 0.931 | 0.931 |

Table 3 : Mean HOPT Scores by Quality Level and Years of Experience Converted to Performance-Effectiveness Factors.

## C. DESCRIPTION OF DATA USED IN THE STUDY

The primary data sources for this analysis are the Reserve Components Common Personnel Data System (RCCPDS) and the Army Manpower Cost System (AMCOS). The Defense Manpower Data Center maintains the RCCPDS. The database contains information on Reserve gains and transactions that occur throughout each soldier's tenure. The U.S. Army Cost and Economic Analysis Center (USACEAC) maintains the AMCOS model. The Army Research Laboratory and Systems Research and Applications Corporation developed the AMCOS model to improve the Army's ability to analyze manpower costs. The AMCOS model uses updated manpower cost factors and reflects current Army personnel policies to establish cost estimates.

This section describes the USAR Selected Reserve databases and cost estimating relationships used in this analysis to determine the life cycle cost-effectiveness of recruit alternatives. It also presents certain demographic characteristics of those soldiers identified as gains to the Selected Reserve for the cohort years under study and their attrition and promotion behavior over time.

### 1. The Reserve Component Common Personnel Data System

The first set of data used in this study is a derivative of the RCCPDS and contains all information about those individuals who entered the Selected Reserve from FY 82

through FY 83. The study uses a seven year tracking period to gather as much data as possible on recruit behavior while avoiding time periods that would skew the data. The goal is to determine characteristic attrition and performance behavior for the recruit categories under study (NPS versus PS and NPS high quality versus NPS low quality). The data encompass two cohorts, namely FY 82 and 83, to minimize the effects of any anomalies that may have occurred during these recruiting years. For instance, FY 82 was the first year the military exclusively used the current version of the ASVAB to categorize enlistees. Since quality is a key parameter used in predicting recruit behavior, using the same version of the ASVAB is important to maintain consistency when comparing categories. Of primary importance to this effort, these files contain information on pay grade, AFQT score, education level, Service component (i.e., Army Reserve, Navy Reserve, etc.), Reserve group (i.e., Selected Reserve, AGR, IRR, etc.), Reserve category (i.e., drilling, training pipeline, etc.), and bonus information. The behavior of each soldier is tracked for seven years to determine whether or not he or she separates from the USAR Selected Reserve or receives promotions. These data elements are critical in determining recruiting, training, compensation, and attrition costs essential to a life cycle cost analysis.

Since the life cycle model uses this data to predict a soldier's behavior, it assumes that soldiers enlisting today will behave in a similar manner in the future. Clearly many factors have changed in the USAR environment that could alter a soldier's behavior now and in the future. For instance, the economy has changed, bonus policies have changed, the deployment policies of Reserve soldiers have changed, and the drawdown has caused severe turbulence affecting the "normal" behavior of Reserve soldiers. Every time something in the Reserve soldier's environment changes, his or her behavior may change. Behavior is hard to predict based on historical data when there is no precedence. Reserve manpower policy planners may want to adjust behavior forecasts accordingly based on more recent experience. This analysis attempts to model "normal" or "steady-state" behavior of USAR Selected Reserve soldiers to estimate life cycle cost-effectiveness.

To obtain steady-state performance, this study only tracks soldier behavior up until Operation Desert Storm (ODS) and the start of the current drawdown to avoid introducing uncharacteristic recruiting and retention policies. During ODS, from August 1990 to March 1991, enlistment patterns for both NPS and PS soldiers changed drastically [Ref. 18, p. 20]. Also, during ODS, the Army limited manpower losses causing a change in the inflow and retention of PS soldiers. Likewise, the current military drawdown beginning in FY 91 caused soldiers to attrit as a result of the inactivation of their units. This attrition behavior is not necessarily representative of normal soldier behavior. Thus, soldier behavior is tracked from FY 82 until the end of FY 90. The life cycle cost-effectiveness model will use these data to obtain representative attrition and promotion estimates for the various recruit categories being studied.

Future users of this approach can easily change estimates for attrition and promotion as more accurate or updated information becomes available.[7] The user can also change the length of the life cycle as long as the attrition, promotion, and cost data are available for the periods being evaluated. This feature is useful in helping military manpower planners evaluate the effects that an entry cohort will have on the career force.

Table 4 depicts the demographic characteristics of the soldiers used in this study. The entry cohorts are defined as USAR Selected Reserve enlisted gains. The cohorts do not include AGR, military technicians nor reenlistment gains. In effect, the data represents USAR Selected Reserve enlisted recruits for TPUs and the IMA program. These tabulated data are based on raw counts from the observed samples. The accuracy of the data is limited because some fields have no entries. For instance, 10 percent of the AFQT scores and four percent of the education levels were unknown. In these cases, the unknown data elements were eliminated from the percentage calculations.

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[7] OCAR uses a model developed by the General Research Corporation (GRC) to forecast attrition behavior of recruit categories and set recruiting goals. GRC updates the model monthly with new attrition data from DMDC. Their attrition model produces recommendations for recruit mixes that meet end strength goals set by DoD. The model uses attrition behavior from most recent seven years to predict future attrition behavior.

| Variable | FY82 | FY83 |
|---|---|---|
| Population | 54,796 | 55,693 |
| AFQT Score | | |
| Category I | 3.8 | 4.4 |
| Category II | 26.8 | 29.2 |
| Category III | 56.7 | 52.5 |
| Category IV | 12.7 | 13.9 |
| Education | | |
| HS Diploma or Currently in | 60.8 | 69.8 |
| Less Than HS | 39.2 | 30.2 |
| Term of Selected Reserve | | |
| 1 Year | 15.8 | 12.9 |
| 2 Year | 1.0 | .8 |
| 3 Year | 22.5 | 23.3 |
| 4 Year | 1.2 | .7 |
| 5 Year | .1 | .1 |
| 6 Year | 59.4 | 61.5 |
| Source of Enlistment | | |
| NPS | 63.4 | 62.7 |
| PS, From Civilian Life | 24.4 | 23.4 |
| PS, From Active Comp. | 4.5 | 6.3 |
| PS, From Another Res Comp | 3.7 | 3.3 |
| PS, Other PS Gain | 3.9 | 4.3 |
| NPS | | |
| High Quality | 53.6 | 51.8 |
| Low Quality | 59.1 | 48.2 |
| With Enlistment Bonus | 17.6 | 20.9 |
| Without Enlistment Bonus | 82.4 | 79.1 |
| PS | | |
| High Quality | 53.6 | 37.6 |
| Low Quality | 46.4 | 62.4 |
| Obligor | 96.1 | 95.7 |
| Non-Obligor | 3.9 | 4.3 |
| With Bonus | .1 | .1 |
| Without Bonus | 99.9 | 99.1 |
| PS Grade at Enlistment | | |
| E-1 | 2.8 | 2.1 |
| E-2 | 4.4 | 3.5 |
| E-3 | 19.8 | 21.6 |
| E-4 | 34.7 | 39.6 |
| E-5 | 26.8 | 22.0 |
| E-6 | 8.1 | 8.0 |
| E-7 | 2.9 | 2.7 |
| E-8 | .4 | .5 |
| E-9 | .1 | .1 |

Table 4: Demographic Composition of Enlisted Selected Reserve Gains, FY82 & 83 (in percent).

To determine attrition behavior, the FY 82 and 83 cohorts were tracked for seven years. Attrition for this life cycle cost-effectiveness study includes all losses to the USAR Selected Reserve force regardless of reason or term of service. However, some soldiers leave the Selected Reserve and subsequently join other Reserve components or the Active

component. This analysis is only concerned with the benefits realized by the USAR Selected Reserve for alternative recruiting policies. Table 5 shows the different attrition rates of the FY 82 and 83 cohorts depending on the perspective of observer.

| Loss Category | FY82 Cohort | FY83 Cohort | Total |
|---|---|---|---|
| NPS USAR Selected Reserve Losses | 86.14% | 84.51% | 85.33% |
| PS USAR Selected Reserve Losses | 72.10% | 74.16% | 73.15% |
| NPS High Quality Selected Reserve Losses | 79.44% | 79.40% | 79.40% |
| NPS Low Quality USAR Selected Reserve Losses | 90.79% | 90.01% | 90.44% |
| Total Loss to the USAR Selected Reserve | 81.01% | 80.65% | 80.83% |
| Total Loss to the USAR | 71.15% | 71.18% | 71.17% |
| Total Loss to All Reserve Components | 69.80% | 69.83% | 69.81% |

Table 5: Attrition for FY82 & 83 USAR Selected Reserve Cohorts at the End of Seven Years

The attrition results reveal that during the period under observation, NPS soldiers attrit at higher rates than PS soldiers, and low quality NPS soldiers attrit at higher rates than high quality NPS soldiers. The data analysis also reveals that 18 percent of the soldiers that leave the USAR Selected Reserve subsequently rejoin in later years. One explanation may be that when soldiers relocate to a new area, they are placed in IRR status. When they arrive at their new location, they rejoin the Selected Reserve. This behavior is accounted for in the life cycle cost-effectiveness model.

As mentioned above, the attrition data used in the life cycle cost-effectiveness model includes all losses to the USAR Selected Reserve. Thus, if soldiers later move into AGR status, become warrant officers, or become commissioned officers in the USAR Selected Reserve, they are not counted in attrition figures. Figure 15 and 16 present the attrition data used in this life cycle cost-effectiveness study.

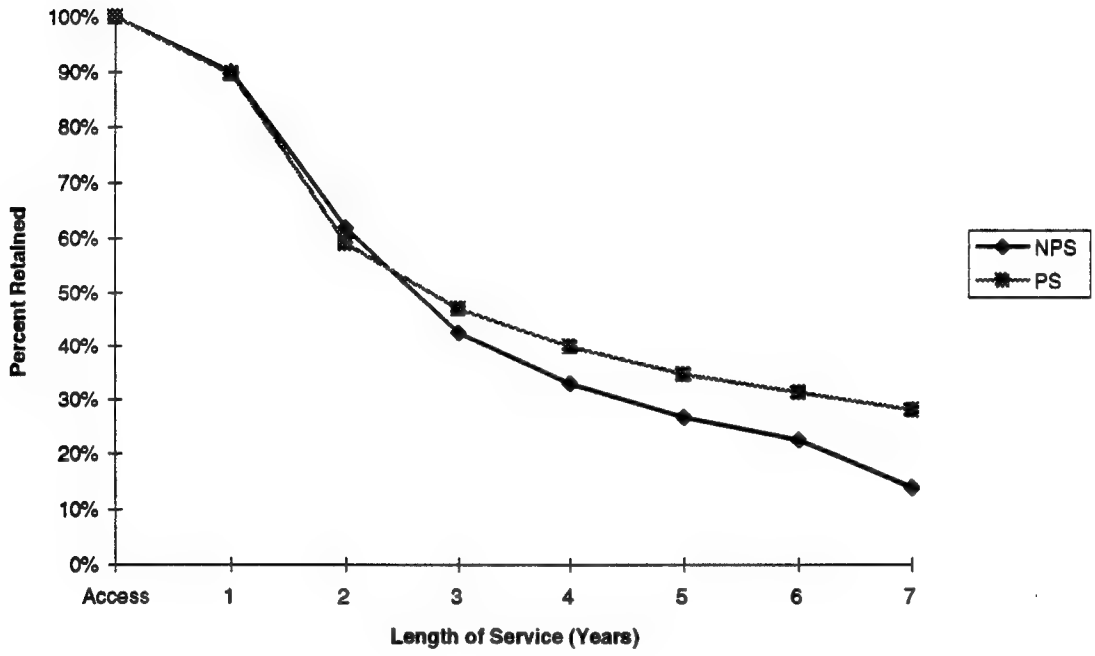


Figure 15: USAR Selected Reserve NPS and PS Average Attrition Rates (FY 82 - FY 89).

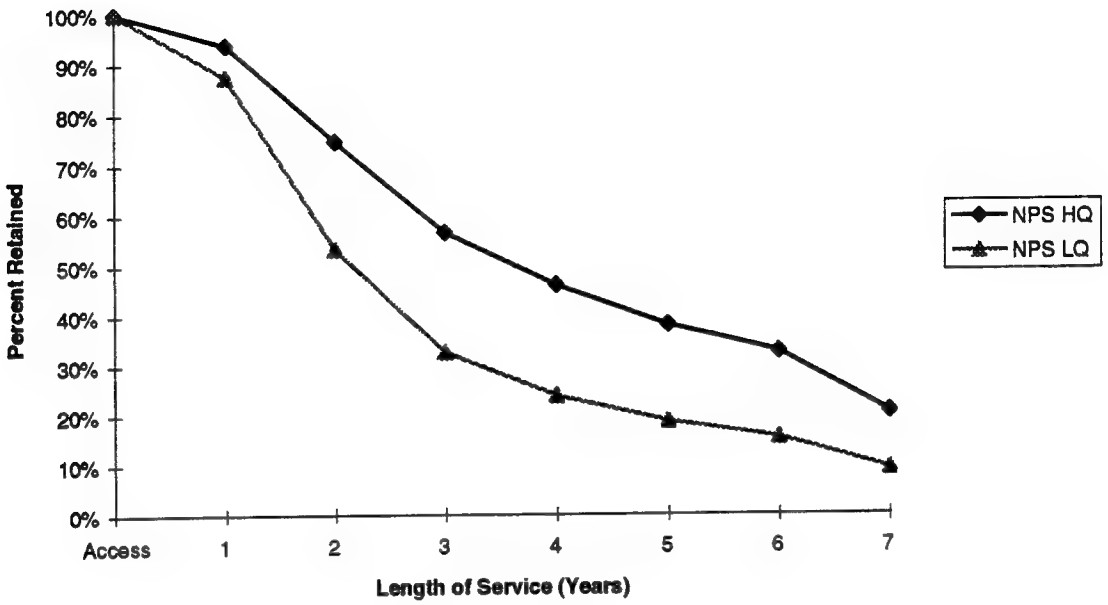


Figure 16: USAR Selected Reserve Average Attrition for NPS High and Low Quality Soldiers (FY 82 - FY 89).

While the model uses attrition data to determine the inventory of soldiers available each year of the life cycle, it uses pay grade data to determine compensation costs. Thus, part of the analysis involved extracting pay grade distributions for the entry cohorts for each year of the life cycle under study. Figures 18 through 20 present the pay grade distributions by recruit categories at accession and after seven years for the cohorts observed. In general, the NPS soldiers were promoted 4.5 times in seven years compared to two promotions for the PS soldiers. NPS high quality soldiers were able to achieve one rank higher than NPS low quality soldiers on average during a seven year period, and more high quality soldiers became officers than low quality soldiers. These results are not surprising. Promotion rates are usually slower at the higher grades, and higher quality soldiers usually perform better and receive promotions faster than lower quality soldiers.

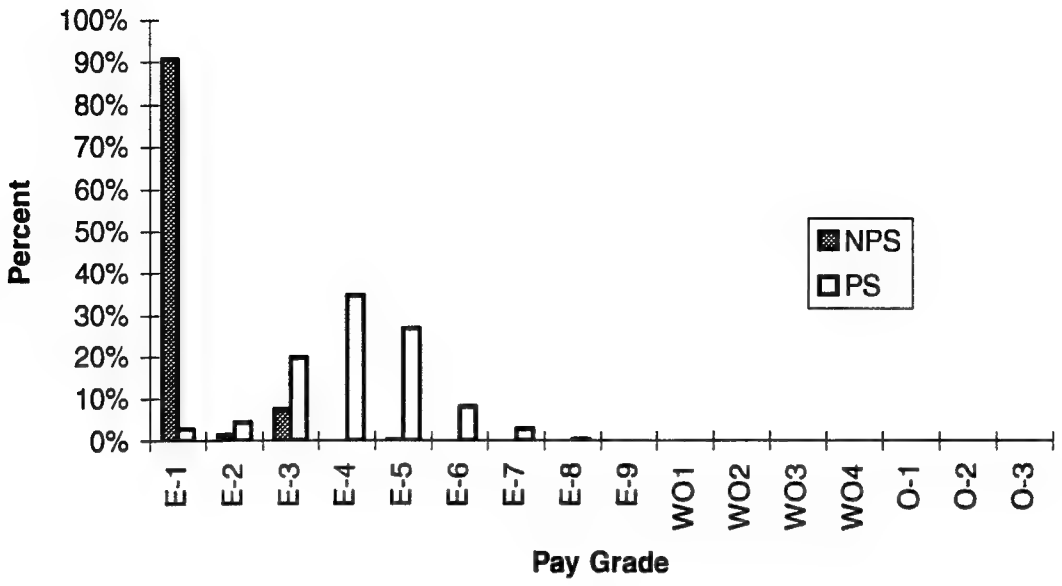


Figure 17: FY 82 Cohort Pay Grade Distribution for NPS and PS Soldiers at Accession.

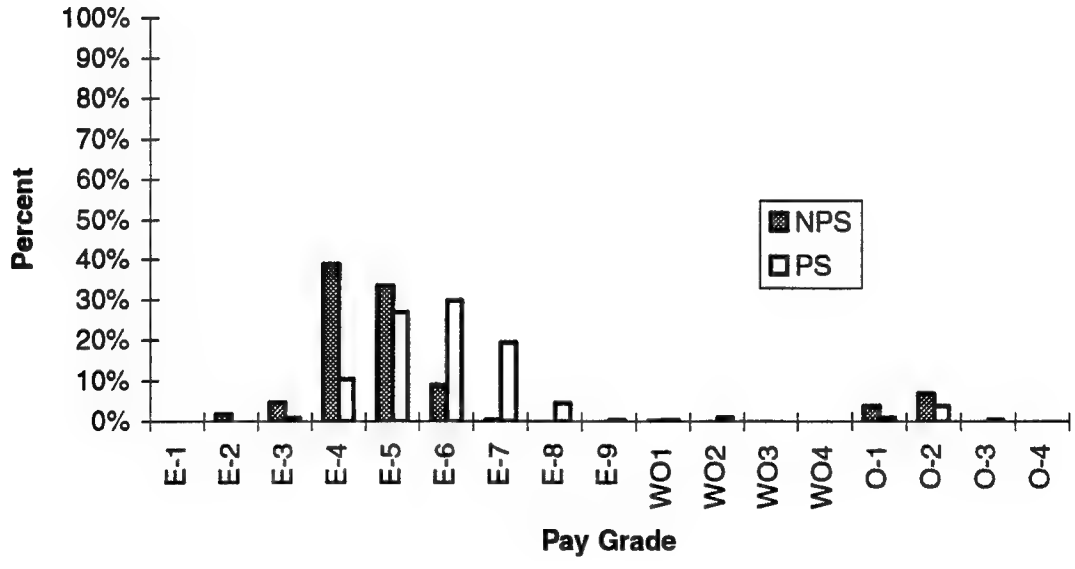


Figure 18: FY 82 Cohort Pay Grade Distribution for NPS and PS Soldiers after Seven Years.

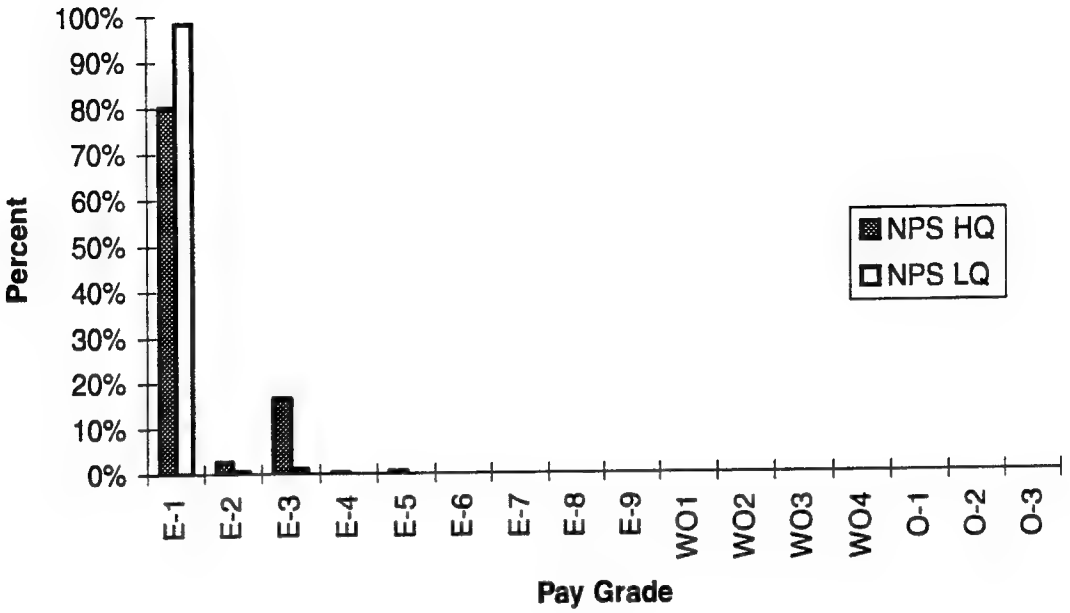


Figure 19: FY 82 Cohort Pay Grade Distribution for NPS High and Low Quality Soldiers at Accession.

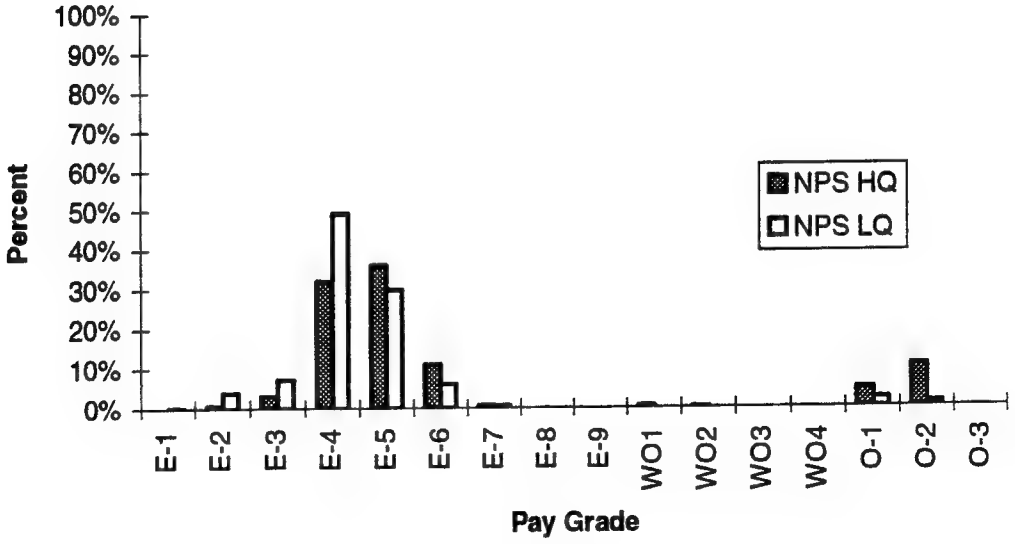


Figure 20: FY 82 Cohort Pay Grade Distribution for NPS High and Low Quality Soldiers after Seven Years.

This section presented the characteristics and behavior of the entry cohorts used in this life cycle cost-effectiveness analysis. The entry cohorts in this study were chosen to provide steady-state performance characteristics. The data are useful in demonstrating the methodology of life cycle cost-effectiveness analysis. This data should be used with caution when making generalizations about present day cohort behavior. The turbulence of the drawdown, changing bonus and promotion policies, and increased use of the Reserves in national emergencies are all likely to affect promotion and attrition behavior. The next section describes the cost estimating relationships and assumptions used in the life cycle cost-effectiveness analysis.

### 2. The Army Manpower Cost System Model

The life cycle cost-effectiveness analysis in this study uses cost estimates derived from the AMCOS model. The Deputy Comptroller of the Army sponsored the AMCOS project to improve the Army's ability to analyze manpower costs. To retain the usefulness of AMCOS, USACEAC oversees updates of the database on a regular basis to reflect current costs and significant manpower policy changes, particularly in regard to Army downsizing. The Reserve component portion of the model estimates the manpower costs of Selected Reserve soldiers using data from five major sources: the RCCPDS, the Reserve Component Budget Justification Books, Training and Doctrine Command training cost data, military pay and allowance tables, and Reserve Component bonus data.. The prices of recruiting resources are calculated from recruiting budgets in a base year (FY 94 President's Budget in this application). The budget figures are distributed to the appropriate cost category by using weighting factors calculated from the FY 93 Selected Reserve inventory. The model converts the underlying data into cost flows using mathematical equations that simulate Army personnel policies. The cost flows vary along the following dimensions:

1. Officer/enlisted;
2. MOS;
3. Pay Grade;

4. High/low quality;
5. Non-prior/prior service;
6. Average/marginal cost;
7. Major appropriation.

The following sections describe how the AMCOS model estimates recruiting, training, and compensation costs. The discussion identifies the cost contributors and some of the assumptions made to arrive at the estimates. The life cycle cost-effectiveness model in this study uses these AMCOS cost figures to estimate the cash flows in a Selected Reserve soldier's life cycle.

***a. Recruiting Costs***

The AMCOS model calculates four types of recruiting and processing costs for four categories of enlisted accessions: PS (with and without a remaining military service obligation) and NPS (high and low quality). The recruiting costs include bonuses to attract enlisted recruits, the Reserve's share of advertising, the cost of recruiters' time, and other processing costs (examinations, accession travel, and USAREC operating costs).

High quality NPS recruits require expenditures from all four of the above cost categories. Low quality recruits are ineligible for bonuses, and the model assumes that the Army Reserve only spends money on advertising to attract high quality recruits. Hence, low quality NPS recruits only accumulate costs of recruiters' time and other processing costs.

PS accessions also generate recruiting, processing, and bonus costs. Those individuals who enter the Selected Reserve with a remaining MSO generate virtually no processing costs, but recruiters spend time and effort to recruit them. These individuals are also eligible to receive an affiliation bonus for electing to serve the remainder of their service in the Selected Reserve. On the other hand, USAREC spends no time and effort to recruit PS individuals who have no remaining MSO, but these soldiers incur processing costs. These individuals are not eligible for an affiliation bonus.

The most complex task in the determination of recruiting costs is estimating the cost of a recruiter's time to access a candidate. The AMCOS model must allocate recruiters' time between high and low quality recruits. The *AMCOS Reserve Component Cost Estimation Model Information Book* [Ref. 19] explains the estimation of this cost as follows:

> [The model] assumes a constant processing time per recruit and a limited queue of recruits. Furthermore, the model assumes that the marginal (and average) cost for each low quality recruit is the processing cost, but that the Army exhausts the queue for high quality recruits, so the marginal cost exceeds the processing cost.
>
> The average time cost per high quality recruit is the sum of the marginal costs for each recruit divided by the number of recruits. The model assumes that half of the recruits are in the queue and that marginal cost rises linearly above the processing cost. In addition, research suggests that a high quality recruit takes six times longer to recruit and process than a low quality recruit, at the margin.[8] [Ref. 19, p. 18]

Figure 21 pictorially represents the relationship between recruit quality and the cost of recruiters' time for high and low quality recruits used in the AMCOS model to estimate the cost of recruiters' time. For low quality recruits, the cost is a constant processing cost, $P_o$. The AMCOS development team solved for the dollar cost of $P_o$ by using the actual distribution of high and low quality recruits in FY 93, along with total recruiter costs, under the assumption that the Army was close to an optimal allocation of recruiters. The cost of recruiting the first half of high quality recruits from zero to Q* is only the processing time, $P_o$. The second half of high quality recruits require additional time to recruit, and the recruiter time rises until it reaches $6P_o$. Hence, the AMCOS model assumes that the first half of recruits can be recruited at an average recruiting time of $P_o$, while the second half can be recruited at an average time of $3.5P_o$. Taking a simple average, the average time to enlist a high quality recruit is $2.25P_o$. [Ref. 19, p. 33]

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8 Daula and Smith (1985) estimate this trade-off to be 8:1 at the margin, while Dertouzos (1985) estimates this trade-off to be 4:1. Although these figures apply to active duty recruiting, the team is aware of no similar research for the Reserve Component.

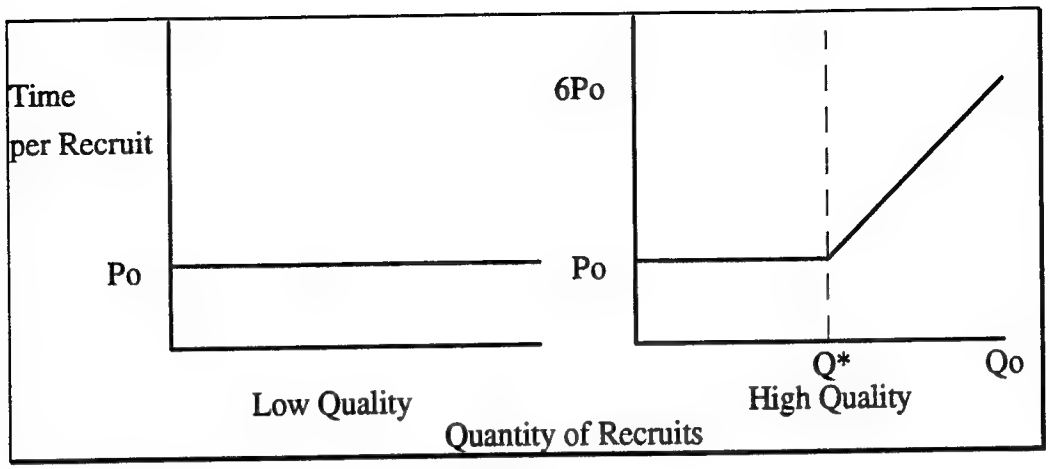


Figure 21: Recruiter Time per Recruit . After Ref. [19].

This approach presents a reasonable estimate of the cost of a recruiter's time as long as the entry cohort is about the same size as the FY 93 entry cohort. However, recruiting is characterized by average costs that *increase* with the total number of high quality individuals recruited. Thus, the AMCOS model estimate for recruiting cost would understate the cost of recruiting if the entry cohort was greater than the one used when they made their estimate. Conversely, it would overstate the costs of a smaller entry cohorts such as those experienced during a drawdown.

Although the recruiting cost estimates require many assumptions, the cost estimates made by the AMCOS model should be adequate to make relative comparisons of alternative accession policies. Again, the user can easily change these estimates as more accurate data becomes available. The recruiting cost estimates produced by the JPM model require a much more complex methodology i.e., a quadratic programming model which accounts for unemployment and various entry cohort sizes. Because of the limitations of the data available, the JPM estimates are not necessarily more accurate.

***b. Training Costs***

Training costs used in the life cycle cost-effectiveness analysis are also estimated using the AMCOS model. The training cost estimates produced by the AMCOS model include the pay and allowances of student and instructor man-years, operation of

the training bases, procurement dollars for training ammunition and training devices, and a portion of funds for maintenance of family housing. The model computes the average cost of training as the cost per graduate multiplied by the probability that a Selected Reserve soldier receives that training. The estimates do not include the costs of recurring training i.e., Inactive Duty Training (IDT) which constitute weekend drills, as they form the compensation costs.[Ref. 19, p. 28]

The AMCOS model calculates the cost of Initial Active Duty for Training (IADT) that all NPS recruits must receive. This training includes basic military skills training (BT), advanced individual skills training (AIT) to acquire an MOS, and one station unit training (OSUT) where both BT and AIT are conducted at one installation. The life cycle cost-effectiveness analysis in this chapter assumes that an NPS soldier attends IADT during the first year in the Selected Reserve, and that the training lasts six months.

The AMCOS model also provides estimates for PS training. PS training includes refresher and cross training for certain PS enlisted personnel. The life cycle cost-effectiveness analysis assumes that those PS soldiers requiring refresher training or cross training receive the training in the first year in the Selected Reserve. The AMCOS model estimates that only 2.35 percent or 1,415 soldiers of FY 93 PS gains into the Selected Reserve required cross training or refresher training.

*c. Compensation Costs*

AMCOS estimates military compensation as the pay and allowances that a Reserve soldier receives for one drill or one day of active duty. Active duty here refers to the 14 days each year that a reservist is participating in Annual Training (AT). The life cycle cost-effectiveness analysis in this chapter multiplies the daily compensation estimates by the number of days a reservist spends in either active duty for training status(ADT) or inactive duty for training (IDT) status. The life cycle model assumes that a soldier spends 48 days per year drilling (IDT status) and 14 days in AT (ADT status). The only exception to this rule is during the first year for NPS soldiers; an NPS soldier spends only

half of the first year drilling and the other half of the first year at IADT. This soldier is not able to attend AT until the second year. Although there are many scenarios an NPS soldier can choose to complete initial training, this assumption is made to simplify cost calculations.

While a reservist is in either IDT or ADT status, the government must pay for the reservist's base pay, retirement accrual and FICA employer's contribution taxes. Base pay is a function of grade and years of service. The model assumes that a Selected Reservist must perform 48 four-hour drills each year, and most units drill four times during one weekend each month. During weekend drills, reservists receive one day's active duty base pay for each drill. As a result, on a normal drill weekend, reservists receive four days' pay for two days' work. The average cost of retired pay accrual is equal to the product of base pay and a fixed normal cost percentage rate obtained from the DoD actuary [Ref. 19, p. 31]. The FICA employer's tax estimate represents the funds paid by the USAR to the Social Security Administration as required by the Federal Insurance Contribution Act [Ref. 19, p. 33]. The life cycle cost-effectiveness analysis assumes that a reservist accumulates all of these compensation costs during 48 drills a year and 14 AT days a year for a total of 62 days a year. The only exception is for NPS soldiers during their first year as noted above.

During AT, reservists are also eligible for Basic Allowance for Quarters (BAQ) and Basic Allowance for Subsistence (BAS). The AMCOS model provides the estimates for these allowances used in the life cycle cost-effectiveness model. The life cycle cost-effectiveness analysis assumes that all reservists attend the 14 day AT each year except for NPS recruits during the first year.

In summary, the life cycle cost-effectiveness analysis conducted here uses cost flows provided by the AMCOS model to estimate recruiting, training, and compensation costs for various accession alternatives. Unfortunately, the life cycle cost-effectiveness analysis is not able to include several costs because either the RCCDPS data or the AMCOS cost data do not support their inclusion. For instance, the costs associated

with the Montgomery GI Bill nor the Student Loan Repayment Program are included in the life cycle cost-effectiveness analysis. The RCCDPS data elements for this information were incomplete. Since these programs are only available to high quality soldiers, they would clearly increase the life cycle cost of a high quality soldier. Other differential cost elements that were not included for similar reasons were reenlistment bonuses and career training costs. The sensitivity analysis conducted below identifies the criticality of the cost assumptions. For further review of the assumptions and underlying cost calculations made in the AMCOS model, consult the *AMCOS Reserve Component Cost Estimation Model Information Book* [Ref. 19].

## D. ANALYSIS OF RESULTS

The purpose of the life cycle cost-effectiveness model as demonstrated in this chapter is to select the best among two alternative recruiting policies on the basis of man-years achieved and life cycle cost. In this scenario, the user inputs the total number of accessions and the desired percentage of NPS or PS soldiers to be recruited. Although it is not demonstrated in this report, policy makers can also use this life cycle cost approach to determine the recruit numbers and mix required to achieve a desired end strength and mix. In either scenario, the life cycle cost approach provides estimates of total life cycle cost, life cycle cost for each category of soldier, and life cycle cost per man-year. The importance of this methodology is that it ensures that economic issues are addressed in terms of the entire soldier life cycle and not just in terms of initial investment.

The analysis below examines two recruiting policy alternatives in terms of NPS and PS mix and two recruiting policy alternatives in terms of NPS high quality and NPS low quality mix. The study for all alternatives uses a seven year life cycle. The seven year life cycle is chosen to study the effects of first term recruit behavior on life cycle costs and man-years. Furthermore, since the maximum term of enlistment for enlisted soldiers in the Selected Reserve is six years, one can study reenlistment behavior and its cost implications by recruit category.

### 1. NPS and PS Mix

Reserve accession policy planners are continually grappling with the "correct" ratio of NPS to PS when drafting recruiting policies. There are many differential costs and benefits that exist between these two categories of recruits. On one hand, NPS soldiers generally offer lower salary costs, greater MOS flexibility, longer contract length, but higher training costs, and potentially lower readiness. On the other hand, PS soldiers have higher salary costs, less MOS flexibility, shorter contract length, but lower training costs, and potentially higher readiness levels. Although readiness levels cannot be evaluated with a life cycle cost-effectiveness analysis, this may be the only effective way to evaluate the other trade-off criteria.

The first alternative under evaluation is a base case consisting of 50,000 accessions with a mix of 50 percent PS and 50 percent NPS recruits. It, therefore, represents one of the recruiting policies proposed for the near future. However, if recruiting and training budgets cannot support this level of NPS recruits, 50,000 accessions with a ratio of 40 percent NPS recruits and 60 percent PS recruits represents another policy alternative. Assume for this analysis that the inflation factors are those provided in the FY 94 Defense Planning Guidance, and the real discount rate is 2.5% in accordance with the Office and Management Budget Circular A-94 [Ref. 20].

By using the estimates of appropriate costs for each activity and for each year in the seven year life cycle the spreadsheet model generates cost profiles for each alternative being evaluated. Figure 22 projects the life cycle costs in the form of a profile. The anticipated cost for each year is indicated along with the cumulative cost for the two alternatives described above. See Appendix B, Table B-1 for a breakdown of the specific data and costs used to generate these results.

The annual cost estimates illustrate the substantial training and recruiting investment the USAR endures to achieve its mission. The cumulative cost profile reveals that the PS-heavy alternative is about $54 million less over the seven year life cycle.

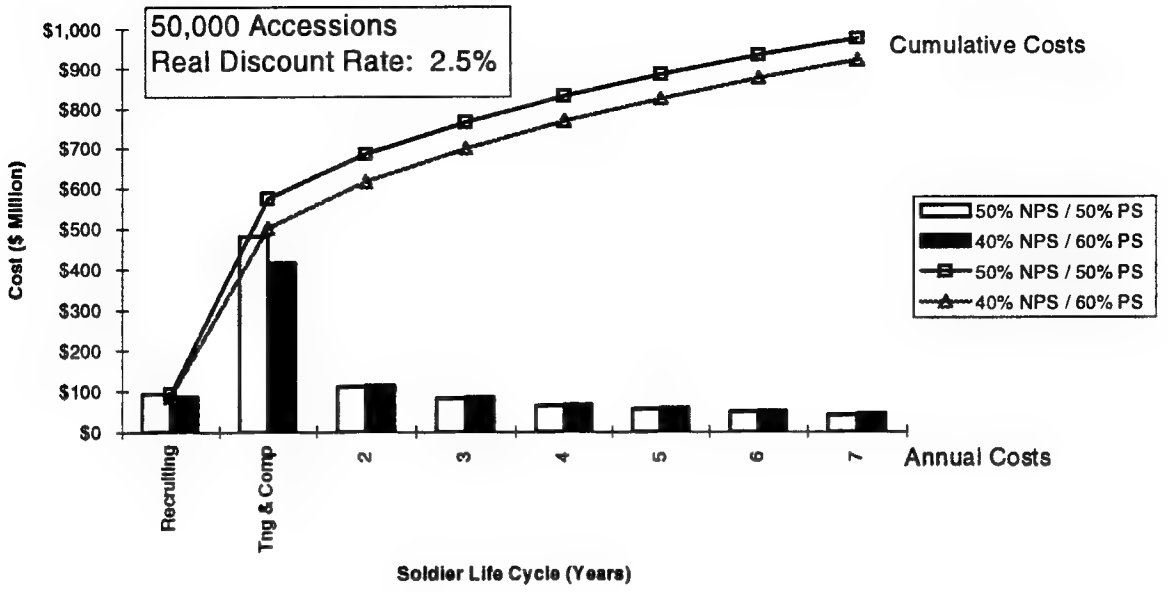


Figure 22: Life Cycle Cost Profile for NPS and PS Recruiting Alternatives Using FY 94 Dollars and a 2.5% Real Discount Rate

Although the cost profile provides a revealing picture of the results, a breakdown of the life cycle costs shows the underlying cost contributors. Table 6 presents a breakdown of life cycle costs for these two policy alternatives. With this information, an analyst can readily pick out the high cost contributors (those which contribute more than 10 percent of the total cost) and perform a more refined analysis of the input data. It is also easy to see costs which may be unrealistically too low.

This cost breakdown structure shows that NPS recruiting costs are higher than PS recruiting costs as expected. The highest cost contributors are found in the areas of NPS training and NPS and PS compensation. The high PS compensation costs result from both higher pay grades and lower attrition rates. However, this technique does not reveal the benefit achieved for each alternative. It is possible for an alternative to be more expensive yet more cost-effective in terms of the level of benefits realized. Thus, the next part of the analysis looks at the alternatives in terms of life cycle cost per man-year.

| | 50% NPS / 50% PS Mix | | 40% NPS / 60% PS Mix | |
|---|---|---|---|---|
| **Cost Category** | **P.V. Cost** | **% of Total** | **P.V. Cost** | **% of Total** |
| **Recruiting Costs** | $93,661,369 | 9.59% | $86,166,223 | 9.35% |
| ***NPS w/bonus*** | $15,119,148 | 1.55% | $12,095,318 | 1.31% |
| ***NPS w/o bonus*** | $50,449,400 | 5.17% | $40,359,520 | 4.38% |
| ***PS w/obligation*** | $27,937,952 | 2.86% | $33,525,542 | 3.64% |
| ***PS w/o obligation*** | $154,869 | 0.02% | $185,843 | 0.02% |
| **Training Costs** | $382,141,070 | 39.15% | $305,869,203 | 33.19% |
| ***NPS IADT*** | $381,750,202 | **39.11%** | $305,400,162 | **33.14%** |
| ***PS Refresher Tng*** | $390,868 | 0.04% | $469,041 | 0.05% |
| **Compensation Costs** | $500,408,343 | 51.26% | $529,485,307 | 57.46% |
| ***NPS*** | $177,511,760 | **18.18%** | $142,009,408 | **15.41%** |
| ***PS*** | $322,896,582 | **33.08%** | $387,475,899 | **42.05%** |
| **Total Discounted LCC** | $976,210,781 | 100.00% | $921,520,733 | 100.00% |

Table 6: Life Cycle Cost Breakdown for NPS and PS Recruiting Alternatives Using FY 94 Dollars and a 2.5% Real Discount Rate

The base case (50 percent NPS and 50 percent PS) has a total life cycle cost of $976 million and provides 174,655 man-years of benefit to the USAR Selected Reserve. This alternative results in an average cost of $5,589 per man-year. The 40 percent NPS and 60 percent PS policy alternative has a total life cycle cost of $922 million and provides 176,267 man-years for an average cost of $5,228 per man-year. Thus, the PS-heavy accession policy is less expensive and provides more benefit for the Selected Reserve. Looking at costs by recruit category, PS soldiers cost $3,846 per man-year and NPS soldiers cost $7,501 per man-year. This result occurs because PS soldiers are less expensive to recruit and train, and they stay in the Selected Reserve longer. These savings more than offset the higher PS compensation costs.

Figure 23 shows the relationship between life cycle cost per man-year and the NPS to PS ratio. The graph suggests that a force composed entirely of PS soldiers would provide the most man-years for the cost. This scenario is clearly not realistic. The cost

estimating parameters are not valid for the extreme ratios of the NPS to PS mix[9]. For instance, the infra-marginal rents for NPS soldiers would be much higher if the Selected Reserve tried to recruit all NPS soldiers. Likewise, the supply of PS soldiers in a region of the required MOSs would probably not support an exclusively PS recruiting policy, at least not without extensive MOS cross-training. Furthermore, the Selected Reserve needs a certain number of soldiers in the lower pay grades to meet mission requirements. PS soldiers, because of their higher average rank upon entry into the Reserves, would not be suited to fill all of the lower ranking positions. Consequently, this type of analysis is bounded by the limitations of the cost estimating parameters, the environment, and the constraints applied by the user.

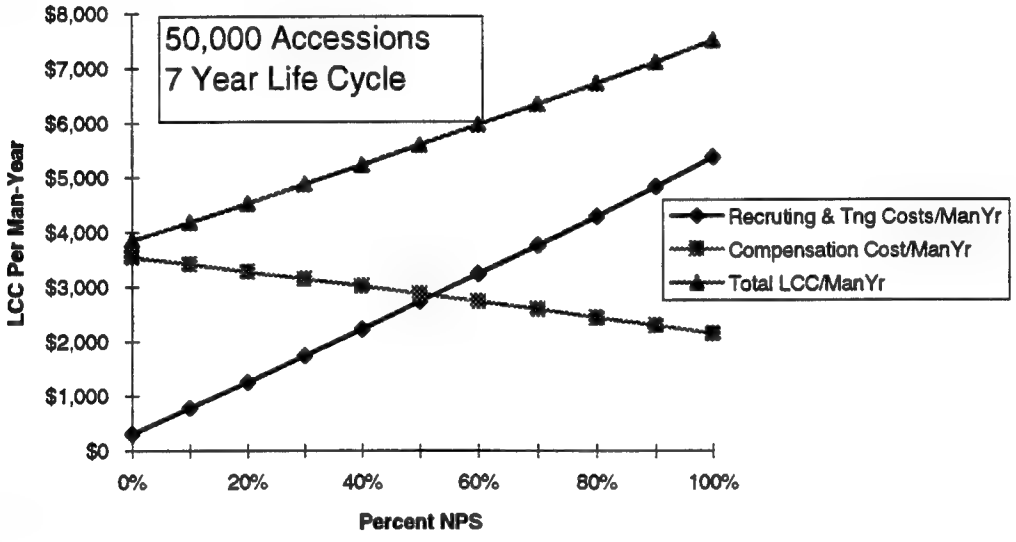


Figure 23: Life Cycle Costs per Man-Year for Various NPS to PS Ratios.

The final step in this study is to conduct a sensitivity analysis of the critical parameters to see if the results change. The analysis presented above represents the benchmark case. Next, the real discount rate is changed from 2.5% to 10% to dampen the

[9] The AMCOS model uses a constant marginal cost assumption based on the FY 93 Reserve Force composition to estimate costs. If the size or composition of the force changed drastically from the FY 93

effects of out-year expenses. Finally, the cost of initial training for NPS soldiers is lowered by $4,000 and the cost of PS cross-training is increased by a multiple of four. The results of the sensitivity analysis are presented in Table 7. In all three scenarios, PS soldiers maintain the lowest cost per man-year. Increasing the discount rate lessened the higher compensation costs associated with PS soldiers increasing the cost advantage of the PS-heavy alternative by $1 million. Decreasing NPS initial training cost and increasing PS training cost decreased the cost spread between the two alternatives by $18 million. Thus, the results are not sensitive to these changes in cost estimating parameters.

| | | | 50%NPS / 50%PS | 40%NPS / 60% PS |
|---|---|---|---|---|
| Parameter Changed | NPS LCC/ManYr | PS LCC/ManYr | LCC ($ Million) | LCC ($ Million) |
| Benchmark | $7,501 | $3,846 | $976 | $922 |
| Real Discount Rate @ 10% | $6,735 | $3,140 | $848 | $793 |
| IADT $4,000 Lower &PS Tng 4 X Higher | $6,389 | $3,859 | $885 | $849 |

Table 7: Sensitivity Analysis for NPS and PS Mix

In summary, the 40 percent NPS alternative is the more cost-effective than the 50 percent NPS alternative based on the data and cost estimating relationships used. Of course, these results assume that soldiers in the future will behave in the same manner as the soldiers in the FY 82 to FY 90 data sample behaved. The results also rely on the accuracy of the cost estimating relationships. The intent is to demonstrate the use of a life cycle cost-effectiveness approach as an alternative means to assist decision makers. The next section uses many of the same data and cost relationships to predict life cycle costs

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force, these cost estimates would be invalid.

and cohort effectiveness for high and low quality NPS soldiers. This analysis follows the same methodology as the analysis of NPS and PS recruit policy alternatives except that it also looks at the effects of performance-adjusted man-years.

### 2. NPS High Quality and Low Quality Mix

The life cycle cost-effectiveness methodology applies equally as well to an analysis of different quality mix recruiting policy alternatives. Unquestionably, the quality level of the Reserve and Active force is at the forefront of discussion among the Services, DoD and Congress. The controversy lies in the high cost associated with recruiting a higher quality cohort. A life cycle cost-effectiveness approach will enable manpower policy planners to answer questions about the trade-offs of a high versus a low quality force.

In the hypothetical analysis presented here, the first Selected Reserve recruiting policy alternative to study is a base case mix of 50 percent high quality NPS recruits and 50 percent low quality NPS recruits. For comparison sake, the second alternative is a quality-heavy mix of 60 percent high quality NPS recruits and 40 percent low quality NPS recruits. Assume that the recruiting goal is 25,000 NPS accessions, the inflation factors follow FY 94 Defense Planning Guidance, and the real discount rate is 2.5%.

Figure 24 presents the cumulative and annual cost profiles for the two alternatives. The cumulative seven year life cycle cost for the 60 percent high quality alternative is about $534 million, and the 50 percent high quality alternative costs about $522 million. Thus, the higher quality accession policy costs about $12 million more over seven years. The profile also reveals that the annual costs are about equal and diverge only slightly in the out-years. The divergence can be explained by the lower attrition rates of higher quality soldiers. The higher quality cohort has more soldiers to pay over the life cycle.

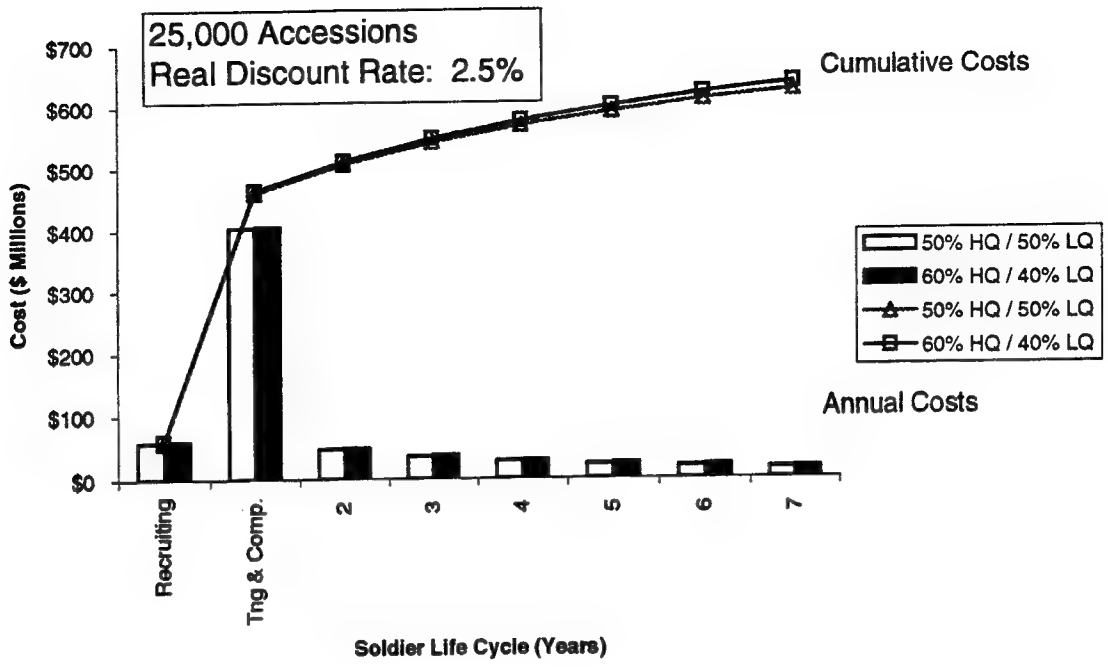


Figure 24: Life Cycle Cost Profile for NPS High and Low Quality Recruiting Alternatives Using FY 94 Dollars and a 2.5% Real Discount Rate.

Table 8 presents the life cycle cost breakdown to assist in identifying high cost contributors. The results show that the higher quality force has higher recruiting costs, perhaps because they require more of the recruiters' time and, under the assumptions of the cost relationships, require more advertising and bonus dollars. The higher quality force is more expensive to train simply because not as many of them attrit and; therefore, there are more soldiers to train and pay. However, the cost profile analysis and cost breakdown analysis do not reveal the difference in man-years realized by the competing alternatives.

The base case alternative has a total life cycle cost of about $626 million and provides 85,934 man-years of service for an average life cycle cost per man-year of $7,287. While the higher quality alternative has a total life cycle cost of about $639 million, it provides 88,834 man-years of service for an average life cycle cost per man-year of $7,191. Even though the higher quality cohort costs more over a seven year life cycle, they provide 2,900 more man-years of service than the lower quality cohort. With the

| | 50% HQ / 50% LQ Mix | | 60 % HQ/ 40% LQ Mix | |
|---|---|---|---|---|
| **Cost Category** | **P.V. Cost** | **% of Total** | **P.V. Cost** | **% of Total** |
| **Recruiting Costs** | $56,675,469 | 9.05% | $58,811,863 | 9.21% |
| ***NPS HQ w/bonus*** | $7,878,970 | 1.26% | $9,454,764 | 1.48% |
| ***NPS HQ w/o bonus*** | $25,799,749 | 4.12% | $30,959,699 | 4.85% |
| ***NPS LQ*** | $22,996,750 | 3.67% | $18,397,400 | 2.88% |
| **Training Costs** | $382,899,791 | 61.15% | $384,171,974 | 60.14% |
| ***NPS HQ IADT*** | $194,620,449 | **31.08%** | $233,544,538 | **36.56%** |
| ***NPS LQ IADT*** | $188,279,342 | **30.07%** | $150,623,474 | **23.58%** |
| **Compensation Costs** | $186,586,153 | 29.80% | $195,857,860 | 30.66% |
| ***HQ*** | $116,472,344 | **18.60%** | $139,766,813 | **21.88%** |
| ***LQ*** | $70,113,809 | **11.20%** | $56,091,047 | 8.78% |
| **Total Discounted LCC** | $626,161,413 | 100.00% | $638,837,735 | 100.00% |

Table 8: Life Cycle Cost Breakdown for NPS High and Low Quality Recruiting Alternatives in FY 94 Dollars using a 2.5% Real Discount Rate.

higher quality mix, the USAR could achieve the same number of man-years of service as with the lower quality mix and save about $8 million over seven years. The savings come from recruiting 24,184 fewer soldiers. Although high quality soldiers cost more to access, they stay in longer to provide more return on the investment. The model shows that a low quality soldier costs $7,878 per man-year while the high quality soldier costs only $6,866 per man-year on average. Thus, the higher quality cohort alternative is more cost-effective.

Figure 25 presents the relationship of cost per man-year for different cohort mixes. The figure illustrates that as the quality content increases, the compensation cost per man-year also increases. The upward trend in compensation cost per man-year suggests that military pay expenditures increase at a faster rate than man-years as the quality content of a cohort increases. On the other hand, recruiting and training investments are spread over a greater number of man-years as the quality content of the cohort increases. Therefore, these initial investment expenses have a decreasing trend. Overall, the graph suggests that the higher the quality content of the cohort, the lower the total life cycle cost per man-year. Of course, the cost estimates used to produce these results would not hold true as the supply of NPS applicants is exhausted. In fact, the USAR would probably have to offer more enlistment bonuses, invest more recruiting time, and advertise more to entice more high quality NPS applicants to enlist. Thus, the relationships presented in Figure 25 should be interpreted with caution. The cost estimates only hold true within a limited range of cohort quality mix ratios.

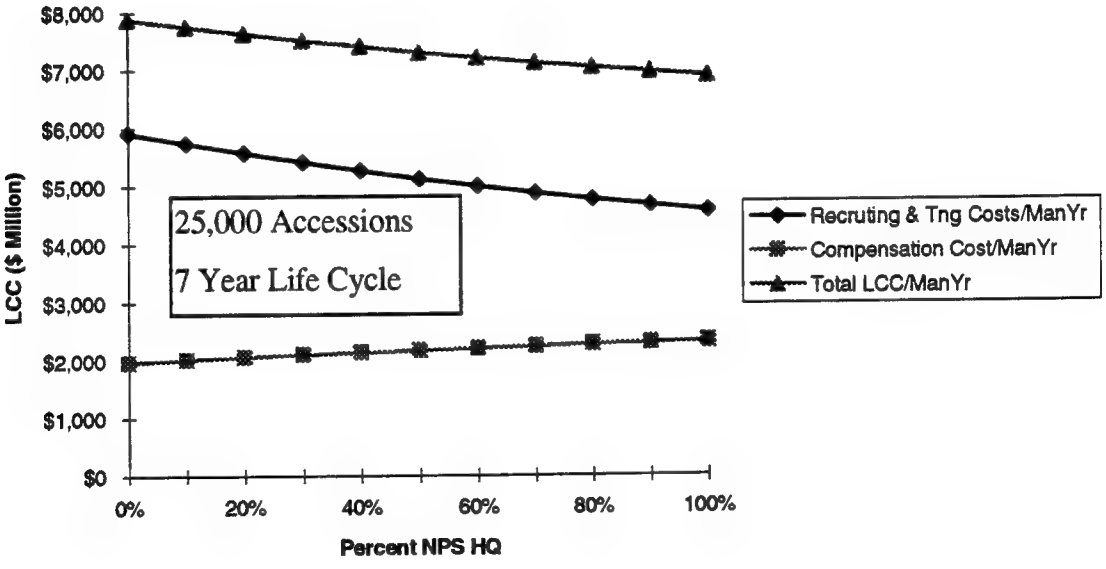


Figure 25: Life Cycle Costs per Man-Year for Various High Quality to Low Quality Ratios.

The cost-effectiveness advantage of the higher quality alternative in this study becomes even more pronounced if you adjust man-years to reflect performance differences. As discussed before, the JPM project established relationships among aptitude, experience, and hands-on performance test. Their results showed that soldier performance improves with aptitude and experience. These relationships are converted into performance-effectiveness factors (see Table 3 on page 56) for use in this model. Table 9 displays the results of adjusting man-years for performance along with a sensitivity analysis for the alternative NPS quality mixes. When man-years are adjusted for performance, the difference in the cost per man-year of a high and low quality soldier is $1,935 compared with a difference of $1,021 when man-years are not adjusted for performance. Thus, factoring performance into the life cycle cost-effectiveness analysis only reinforces the value of a high quality soldier.

The analysis in Table 9 shows that the results are not sensitive to changes in critical parameters. Even when the cost of recruiting a high quality soldier is increased by $500 and the cost of recruiting a low quality soldier is decreased by $500, the high quality soldier maintains a lower cost per man-year. The additional man-years gained with increased quality content more than defray the higher recruiting costs associated a high quality soldier.

In conclusion, this study illustrated the use of a life cycle cost-effectiveness analysis methodology to evaluate different manpower recruiting policies. In our analysis, we evaluated competing alternatives of NPS to PS cohort mixes and high quality NPS to low quality NPS cohort mixes. The results of the analysis revealed that the PS-heavy alternative is the most cost-effective over a seven year life cycle. The PS-heavy mix had a lower life cycle cost and a lower cost per man-year. In the evaluation of the quality content of the NPS entry cohort, the higher quality accession mix was more cost-effective than the lower quality alternative. Although the lower quality alternative had a lower life cycle cost, the higher quality cohort had a lower cost per man-year. An alternative way to interpret this result is that the higher quality mix provides more man-years of service for

| Parameter Changed | LCC ($ Million) | 50% HQ / 50% LQ HQ LCC/ManYr | LQ LCC/ManYr | LCC ($ Million) | 60% HQ / 40% LQ HQ LCC/ManYr | LQ LCC/ManYr |
|---|---|---|---|---|---|---|
| Benchmark[10] | $626 | $6,866 | $7,878 | $639 | $6,866 | $7,878 |
| Performance Adjusted Man-Years | $626 | $7,189 | $9,121 | $639 | $7,189 | $9,121 |
| Real Discount Rate @ 10% | $560 | $6,076 | $7,127 | $570 | $6,076 | $7,127 |
| Increase HQ Rctng Cost $500 -Decrease LQ Rctng Cost $500 | $626 | $6,990 | $7,703 | $641 | $6,990 | $7,703 |

Table 9: Sensitivity Analysis for NPS High and Low Quality Mix

the same cost as the lower quality alternative, or, conversely, provides the same number of man-years at a lower cost. When adjusting the man-years of service to account for the differences in performance, the cost-effectiveness advantage of the higher quality cohort was even more pronounced. The sensitivity analysis for both analyses showed that the cost-effectiveness of the alternatives changed with changes in certain critical parameters but not enough to change the overall results.

The life cycle analysis conducted in this chapter used historical data to predict the behavior of future entry cohorts. This data showed that PS soldiers stayed in the USAR Selected Reserve longer than their NPS counterparts for the cohorts and years studied. It also showed that high quality NPS soldiers had less attrition and were promoted faster. These soldier behavior patterns proved to be the dominant factor in determining life cycle cost-effectiveness of recruiting policy alternatives. However, the current and future environment including the drawdown and changing roles and missions of the Reserves is likely to alter soldier behavior in the future. Manpower planners can only use the best data available to predict future soldier behavior. Regardless, the methodology presented

[10] The benchmark case represents the results of the analysis conducted above. The real discount rate is 2.5% and cost estimating parameters remain unchanged.

in this chapter has merit over a unit cost approach to allocate resources. Manpower decisions have life cycle implications that are not considered when focusing solely on investment costs. Keep in mind; however, that the life cycle cost-effectiveness analysis provides only part of the information needed in making the best decision. The decision maker must evaluate all quantitative and qualitative criteria. For instance, the decision maker may want to consider the socio-economic impacts, the costs of disciplinary problems, and the first-term career mix implications of each alternative under consideration. These factors place additional constraints on the problem solving approach. A model which provides an "optimum" solution without allowing the user to consider these constraints loses validity. In this regard, a simple and adaptable life cycle model allows the decision maker to consider environmental factors while ensuring the policy selected reflects economic issues.

# V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## A. SUMMARY AND CONCLUSIONS

This thesis provided a brief overview of the Army Reserve recruiting process, examined unit cost resourcing in the recruiting environment, and proposed a life cycle cost-effectiveness methodology for evaluating alternative accession policies.

Chapter I emphasized the importance of cost-effective manpower procurement policies for the Army Reserve. Because the Reserves are being asked to assume more roles and missions in a fiscally constrained environment, cost-effective manpower procurement policies are more important than ever. However, if the Reserves and USAREC do not have the information and analytical tools needed to justify the cost-effectiveness of their accession programs to Congress, they may lose support. Thus, the motive for this research grew out of the Army Reserve's need for a methodology to select and justify cost-effective manpower procurement policy.

### 1. The Reserve Recruiting Process

Chapter II provided an overview of the Army Reserve structure and the Reserve recruiting process. The discussion included information on Reserve roles and missions, composition of the USAR, Total Force supply and demand issues, and a look at the unique challenges of Reserve recruiting.

This overview showed the critical link between the Active and Reserve forces' personnel policies. The trends in Active force staffing dramatically affect outyear USAR force levels. Because of the drawdown of Active forces, the PS supply pool should provide adequate numbers to meet demand, at least until the turn of the century. Furthermore, given the projections of available youth through the year 2000, there should not be a shortage of quality NPS applicants to meet demand. Beyond the turn of the century, if the size of the Reserve force remains large relative to the size of the Active

force, the PS supply pool may become critically low. All manpower policy decisions should consider the impacts on the Total Force.

The overview of the Reserve recruiting process also showed that the supply and demand for Reserve recruits is determined at the local level. Reserve recruiters must match applicants with the needs of the Reserve units in their recruiting region. This requirement amplifies the trade-offs of accessing NPS versus PS recruits. While PS soldiers require little training and recruiting investment, they do not always possess the job skills needed by local Reserve units. On the other hand, NPS soldiers can be trained to meet local unit requirements, but they require substantial recruiting and training investments. Thus, the need for an analytical approach to evaluate policy trade-offs is further reinforced.

### 2. Unit Cost Resourcing

Chapter III provided an in depth analysis of DoD's application of the unit cost resourcing concept to Reserve recruiting. The discussion began with DoD's stated objectives of unit costing, examined the inputs and outputs of the unit cost calculation, and finished with a critique of the usefulness of unit costing to accomplish the stated objectives.

DoD introduced unit costing into the Reserve recruiting environment in FY 91 to focus attention on the total cost to produce a recruit. They intended this business-type cost accounting system to provide the following advantages:

1. Facilitate efficient management by creating an incentive for managers to minimize costs;
2. Provide standardized performance measures;
3. Support budget requests;
4. Provide improved decision making at the OSD level to better allocate resources;
5. Report (in financial terms) the status and results of activities.

This analysis uncovered several limitations of the unit cost approach. It is unlikely that unit cost resourcing will accomplish DoD's stated objectives in the recruiting

environment. Specifically, unit costing provides puzzling incentives for management to cut costs, deceptive information on the status and performance of USAREC activities, and inadequate information to use as a budget allocation tool.

### *a. Lack of Incentives to Make Efficient Cuts*

There are two major reasons why unit costing at USAREC does not provide incentives to minimize costs. First, if USAREC reduces costs in the short run, their future budget authority will be reduced accordingly so that they "break-even." Reduced funding may make meeting accession demand and quality goals more difficult in an environment where the propensity to enlist is constantly changing. Second, since USAREC only manages about 22 percent of their expenditures, any cost saving actions will be overshadowed by the remaining 78 percent of expenditures which they do not control. Military pay, constituting 69 percent of expenditures to support recruiting, is based on USAREC's authorized strength and not their actual strength. Any reductions in personnel will not be reflected in the unit cost calculation. In fact, USAREC will be tempted to carry excess personnel as a buffer for future increased workloads. Thus, the unit cost approach applied to recruiting provides confusing incentives to minimize costs.

### *b. Data Accuracy*

Another intended purpose of unit costing is to report the status and performance of activities in financial terms. This goal requires that all costs are identified and allocated to outputs. However, USAREC does not have an adequate accounting system to accurately allocate expenditures. First, the composite rates and authorized strength numbers used to calculate military pay do not reflect true manpower costs. Second, a significant amount of Active OMA funds are spent in support of the Reserve recruiting effort. These funds are not allocated to Reserve accessions because they are difficult to quantify. Third, the accounting system is not able to distinguish different costs for dissimilar outputs. The unit cost figure suggests that high quality, low quality, PS, and NPS recruits cost the same to access. Failure to account for the cost differences of different types of recruits could result in a verdict of inefficiency at USAREC. These

significant accounting problems make the unit cost deceptive as a measure of true unit cost per accession and inadequate as a tool for decision making and budgeting.

#### *c. Resource Allocation Using Unit Cost*

DoD's unit costing approach assumes that all costs are variable and that the average cost of an accession equates to the marginal cost of an accession. However, many of USAREC's costs are fixed and do not change with the level of accessions. As a result, DoD ignores the real possibility of divergence between marginal and unit cost. Also, the unit cost figure is merely a "snap-shot" of cost per accession. It does not consider the life cycle costs of a recruit. Although unit cost focuses USAREC's attention on the total cost per accession, it does not provide accurate information needed to make resource allocation decisions. Life cycle costs and marginal costs must be considered when making policy decisions to efficiently allocate resources.

### 3. Life Cycle Cost-Effectiveness Analysis

Chapter IV introduces a life cycle cost-effectiveness methodology for evaluating USAR Selected Reserve accession policy. The chapter presents the demographic characteristics, attrition rates, and promotion rates for the cohorts used in the study. This information is used to predict the behavior and costs of recruits over time based on aptitude, education level, and military experience.

The study found that PS soldiers in the sample group had a much lower attrition rate over seven years than NPS soldiers. Likewise, high quality soldiers attritted less over seven years than their lower quality counterparts. The attrition rate of soldiers was the critical parameter in determining the cost-effectiveness of alternative accession policies. In this analysis, the accession policy with the highest percentage of PS soldiers relative to NPS soldiers was the most cost-effective. The accession policy with the highest percentage of high quality NPS soldiers relative to low quality NPS soldiers was the most cost effective. The results did not change with significant changes in critical cost estimating parameters. Given that the estimating parameters used in this study are valid,

the USAR should select the accession policy with the highest percentage of PS and high quality NPS soldiers as possible.

The study also considered the effects of job performance on cost-effectiveness. Soldiers with higher aptitudes and more experience tend to perform better than their lower aptitude and lower experience counterparts. When considering job performance, the cost-effectiveness of the higher quality NPS policy alternative was even more pronounced.

The results of this study showed that the life cycle cost-effectiveness methodology is useful for evaluating alternative accession policies. The validity of the results rely on the soundness of the cost estimating parameters and soldier behavior data. Much of this data is readily available or can be easily obtained to improve the accuracy of the results. While it is often popular to consider only investment costs in making policy decisions, there are life cycle implications associated with almost all accession policies. By using the methodology demonstrated here, decision makers can ensure they address the economic issues of military manpower planning in terms of personnel life cycle.

## B. RECOMMENDATIONS

### 1. Unit Costing Measures

1. The USAR and USAREC should use marginal life cycle cost to allocate resources for recruiting. Unit cost should not be used to set USAREC's budget nor measure performance without major revisions.
2. USAREC should overhaul its accounting system. The accounting system should recognize different costs for dissimilar outputs and should allocate expenditures to the outputs that generated them. In this way, USAREC will know the true costs for accessing high quality, low quality, NPS, and PS recruits and will not allocate Active OMA funds to Reserve accessions. Leadership will have more accurate cost data for decision making.
3. DoD should calculate military pay expenditures based on actual strength and grade instead of authorized strength and composite rates.

## 2. Life Cycle Cost

1. The USAR should use a life cycle cost-effectiveness methodology to evaluate alternative accession policies.
2. The USAR should use life cycle costs and marginal costs in all resource allocation decisions.
3. The USAR should more accurately define accession policy constraints. They should determine the minimum requirements for PS and NPS soldiers needed on a macro level for the USAR Selected Reserve.
4. The USAR should develop more accurate tools and data to predict soldier behavior over time, i.e., attrition rates, promotion rates, number of PS soldiers requiring cross-training, etc.
5. The USAR should develop more accurate cost estimating relationships and data to predict soldier life cycle costs, i.e., cost to recruit a high quality NPS soldier, cost to train a PS soldier, etc.
6. The USAR should develop innovative PS cross-training programs to maximize the potential of the PS supply pool.

# APPENDIX A. [USAREC EXPENDITURES]

# USAREC BIG TEN (FY 80 - 01) FY 95 CONSTANT $M

| MPA | FY 80 | FY 81 | FY 82 | FY 83 | FY 84 | FY 85 | FY 86 | FY 87 | FY 88 | FY 89 | FY 90 | FY 91 | FY 92 | FY 93 | FY 94 | FY 95 | FY 96 | FY 97 | FY 98 | FY 99 | FY 00 | FY 01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENLISTMENT INCENTIVES | 10.7 | 10.0 | 12.1 | 19.6 | 18.4 | 16.7 | 14.5 | 20.4 | 27.7 | 14.6 | 12.5 | 10.7 | 11.5 | 10.0 | 6.4 | 6.2 | 6.0 | 6.5 | 6.3 | 6.2 | 6.2 | 6.2 |
| MILITARY PAY | 94.4 | 91.3 | 91.6 | 97.7 | 98.7 | 128.5 | 120.0 | 113.5 | 109.2 | 97.4 | 90.2 | 93.8 | 87.8 | 77.0 | 78.8 | 78.2 | 77.8 | 76.9 | 76.5 | 76.1 | 76.1 | 76.1 |
| RECRUITER AIDES | 2.2 | 2.0 | 1.8 | 1.6 | 2.7 | 2.9 | 2.3 | 2.5 | 2.2 | 2.5 | 2.0 | 2.3 | 1.2 | 0.3 | 1.1 | 1.2 | 1.3 | 1.2 | 1.4 | 1.5 | 1.5 | 1.5 |
| (TOTAL RPA) | 107.3 | 103.2 | 105.4 | 118.8 | 119.7 | 148.1 | 136.9 | 136.4 | 139.1 | 114.5 | 104.7 | 106.8 | 100.4 | 87.2 | 86.3 | 85.6 | 85.0 | 84.7 | 84.2 | 83.8 | 83.8 | 83.8 |
| **OMAR** | | | | | | | | | | | | | | | | | | | | | | |
| CIVILIAN PAY | 12.5 | 12.6 | 10.7 | 8.9 | 7.6 | 7.5 | 6.0 | 5.3 | 4.7 | 4.2 | 3.9 | 3.7 | 3.6 | 3.4 | 3.6 | 3.5 | 3.4 | 3.3 | 3.3 | 3.2 | 3.2 | 3.2 |
| ADVERTISING | 22.8 | 22.1 | 22.0 | 23.7 | 25.0 | 25.2 | 25.2 | 28.4 | 26.0 | 21.2 | 21.3 | 20.8 | 15.0 | 10.5 | 10.0 | 6.2 | 5.7 | 4.9 | 4.5 | 3.8 | 3.8 | 3.8 |
| RECRUITER SUPPORT | 12.2 | 13.3 | 13.0 | 13.0 | 12.6 | 16.3 | 16.0 | 16.4 | 15.3 | 15.7 | 16.4 | 14.2 | 14.4 | 12.6 | 12.6 | 8.9 | 9.0 | 9.2 | 9.5 | 9.7 | 9.7 | 9.7 |
| (TOTAL USAREC OMAR) | 47.5 | 48.0 | 45.8 | 45.5 | 45.2 | 49.1 | 47.2 | 50.1 | 45.9 | 41.1 | 41.5 | 38.7 | 33.0 | 26.6 | 26.2 | 18.6 | 18.2 | 17.4 | 17.3 | 16.7 | 16.7 | 16.7 |
| HQ ADP SUPPORT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.9 | 8.8 | 4.6 | 3.1 | 2.6 | 1.7 | 2.5 | 2.9 | 2.1 | 2.0 | 2.1 | 2.1 | 2.4 | 2.4 | 2.4 |
| TOTAL BIG 10 | 154.8 | 151.2 | 151.2 | 164.4 | 164.9 | 197.2 | 184.1 | 189.3 | 193.9 | 160.1 | 149.3 | 148.1 | 135.2 | 116.4 | 115.4 | 106.3 | 105.3 | 104.2 | 103.6 | 102.9 | 102.9 | 102.9 |
| ACCESSION MISSION | 61327 | 64647 | 66946 | 65386 | 61911 | 68261 | 69230 | 66440 | 64179 | 66574 | 57357 | 51369 | 52500 | 43069 | 40000 | 45515 | 47683 | 46681 | 48798 | 51949 | 51433 | 51433 |
| GROSS ACTUAL COST PER ACCESSION | 2524.9 | 2339.0 | 2258.4 | 2513.7 | 2663.9 | 2888.4 | 2659.4 | 2849.4 | 3021.2 | 2405.4 | 2603.6 | 2883.0 | 2574.6 | 2701.7 | 2884.2 | 2335.5 | 2207.4 | 2231.8 | 2122.9 | 1980.3 | 2000.1 | 2000.1 |

Table A- 1: USAREC Expenditures in Support of Reserve Recruiting Effort.
FY80-93 Actual Figures; FY94-01 Projected; Constant FY95 $Million. (Source: USAREC).

# APPENDIX B. [LIFE CYCLE COST-EFFECTIVENESS MODEL]

# NON-PRIOR SERVICE DATA TABLE

**NPS**

| | |
|---|---|
| w/Bonus[1] | 18% |
| w/o Bonus | 82% |

| | Years in USAR Selected Reserves | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Grade Distribution | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| E-1 - E-3 | 99.70% | 99.24% | 89.21% | 60.55% | 40.81% | 22.23% | 15.24% | 6.76% |
| E-4 | 0.05% | 0.41% | 6.83% | 32.20% | 46.12% | 54.88% | 49.32% | 38.76% |
| E-5 | 0.23% | 0.33% | 3.89% | 5.57% | 9.02% | 15.98% | 24.49% | 33.67% |
| E-6 | 0.01% | 0.00% | 0.01% | 0.09% | 0.37% | 1.23% | 3.75% | 9.01% |
| E-7 | 0.01% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.13% | 0.50% |
| WO1 | 0.00% | 0.00% | 0.00% | 0.04% | 0.07% | 0.12% | 0.17% | 0.23% |
| WO2 | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.01% | 0.05% | 0.10% |
| O-1 | 0.00% | 0.01% | 0.05% | 1.54% | 3.58% | 5.48% | 4.86% | 3.99% |
| O-2 | 0.00% | 0.00% | 0.00% | 0.02% | 0.03% | 0.06% | 1.97% | 6.89% |
| O-3 | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.01% | 0.03% | 0.04% |

**NPS Costs**

| *Military Comp.* | E1-E3 | E-4 | E-5 | E-6 | E-7 | E-8 | E-9 | WO1 | WO2 |
|---|---|---|---|---|---|---|---|---|---|
| MC1(Daily)[2] | $36.42 | $47.87 | $57.67 | $68.76 | $84.94 | $100.38 | $118.14 | $81.19 | $17.97 |
| MC2(Daily)[3] | $11.50 | $13.62 | $15.93 | $17.38 | $18.68 | $20.21 | $21.94 | $17.97 | $20.08 |

| *Recruiting Costs* | | O-1 | O-2 | O-3 | O-4 |
|---|---|---|---|---|---|
| ac_hq(w/bonus) | $3,581 | | | | |
| ac_hq(w/o bonus) | $2,505 | $75.52 | $96.76 | $124.89 | $148.86 |
| ac_lq | $1,840 | $13.74 | $17.83 | $21.37 | $25.66 |
| ac_nps w/Bonus | $3,436 | | | | |
| ac_nps w/o Bonus | $2,449 | | | | |

| *Training Costs* | | | Used for sensitivity analysis |
|---|---|---|---|
| ac_iadt | $16,484 | $12,484 | ($4,000 increase in IADT training) |

Table B- 1: Data Used in LCC Analysis for Non-Prior Service Soldiers

# PRIOR SERVICE DATA TABLE

**PS**

| | |
|---|---|
| Obligor | 0.961 |
| Non-Obligor | 0.039 |
| w/Bonus[4] | 0.001 |
| w/o Bonus | 0.991 |

| | | | | | Years in USAR Selected Reserves | | | |
|---|---|---|---|---|---|---|---|---|
| Grade Distribution | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| E-1 - E-3 | 27.12% | 23.70% | 10.67% | 4.92% | 3.15% | 2.42% | 1.65% | 1.09% |
| E-4 | 34.65% | 36.83% | 37.66% | 30.62% | 25.19% | 19.97% | 14.46% | 10.43% |
| E-5 | 26.77% | 26.79% | 30.49% | 34.16% | 34.76% | 32.38% | 30.35% | 26.91% |
| E-6 | 8.13% | 8.68% | 12.92% | 18.15% | 21.51% | 25.00% | 27.74% | 29.83% |
| E-7 | 2.88% | 3.13% | 4.99% | 7.01% | 8.93% | 12.06% | 15.32% | 19.48% |
| E-8 | 0.39% | 0.44% | 0.89% | 1.29% | 1.76% | 2.41% | 3.55% | 4.54% |
| E-9 | 0.05% | 0.07% | 0.09% | 0.13% | 0.18% | 0.26% | 0.30% | 0.45% |
| WO1 | 0.00% | 0.01% | 0.11% | 0.29% | 0.44% | 0.55% | 0.59% | 0.48% |
| WO2 | 0.00% | 0.00% | 0.01% | 0.04% | 0.19% | 0.45% | 0.59% | 0.98% |
| O-1 | 0.00% | 0.33% | 2.10% | 3.22% | 3.28% | 2.46% | 1.90% | 1.13% |
| O-2 | 0.00% | 0.02% | 0.04% | 0.13% | 0.54% | 1.87% | 3.05% | 4.01% |
| O-3 | 0.00% | 0.00% | 0.03% | 0.04% | 0.08% | 0.16% | 0.30% | 0.64% |
| O-4 | 0.00% | 0.00% | 0.01% | 0.01% | 0.01% | 0.00% | 0.02% | 0.02% |

PS Costs — Used in sensitivity analysis (4 X PS training cost)

| | |
|---|---|
| *Recruiting Costs* | |
| ac_ps Obligor[5] | $1,163 |
| ac_ps Non-Ob[6] | $159 |

| *Training Costs* | E1-E3 | E-4 | E-5 | E-6 | E-7 | E-8 | E-9 |
|---|---|---|---|---|---|---|---|
| ac_pst[7] | $21.24 | $21.80 | $10.38 | $6.82 | $7.72 | $9.04 | $3.84 |
| | $84.96 | $87.20 | $41.52 | $27.28 | $30.88 | $36.16 | $15.36 |

Notes
1. In the NPS category, only high quality soldiers can receive an enlistment bonus
2. MC1= Base Pay+Retirement Accrual+FICA - for ADT and AT (48 + 14 days per year)
3. MC2=BAQ+BAS - for AT only (14 days per year)
4. Only PS applicants with a remaining MSO can receive an enlistment bonus
5. Obligor PS soldiers only require recruiter's time and no processing time
6. Non-obligor PS soldiers only require processing time and no recruiter's time
7. The average cost of PS training is multiplied times the entire PS inventory.

Only differential costs are included in the analysis. Costs not included are:

Career Training - Specialized skill training independent of category

Reenlistment Bonus - bonus for targeted skills and units independent of category.

Misc Costs - Disability, Hospitalization, Death Gratuity, CHAMPUS, and Uniform expenses.

MGIB - The cost model does not differentiate among categories.

Student Loan Repayment Program - The cost model does not differentiate among categories.

Table B-2: Data Used in LCC Analysis for Prior Service Soldiers

## LCC FOR NPS SOLDIERS

| | Access | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **End of FY Attrition %** | | 10.10% | 31.09% | 31.48% | 22.50% | 19.22% | 15.41% | 38.36% |
| **End of FY Inventory** | 25,001 | 22,476 | 15,489 | 10,613 | 8,225 | 6,644 | 5,620 | 3,464 |
| **Mid-Year Inventory** | | 23,739 | 18,982 | 13,051 | 9,419 | 7,435 | 6,132 | 4,542 |
| **Cost (Constant FY94 $)** | | | | | | | | |
| *Recruiting* | $65,571,171 | | | | | | | |
| *Training*[1] | | $391,305,574 | | | | | | |
| *Compensation*[2,3] | | $20,811,903 | $47,919,184 | $36,227,969 | $28,100,946 | $23,878,853 | $20,880,747 | $15,921,526 |
| **Total** | $65,571,171 | $412,117,477 | $47,919,184 | $36,227,969 | $28,100,946 | $23,878,853 | $20,880,747 | $15,921,526 |
| **Discount Factor @ 2.5%**[4] | 1.000 | 0.976 | 0.952 | 0.929 | 0.906 | 0.884 | 0.862 | 0.841 |
| **PV Cost Flows** | $65,571,171 | $402,065,831 | $45,610,169 | $33,641,271 | $25,458,070 | $21,105,426 | $18,005,402 | $13,394,226 |
| **PV of 7Yr Life Cycle** | $624,851,567 | | | | | | | |

## LCC FOR PS SOLDIERS

| | Access | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **End of FY Attrition %** | | 10.42% | 34.01% | 20.51% | 15.02% | 13.24% | 9.80% | 10.70% |
| **End of FY Inventory** | 25,001 | 22,395 | 14,778 | 11,747 | 9,982 | 8,660 | 7,812 | 6,975 |
| **Mid-Year Inventory** | | 23,698 | 18,587 | 13,262 | 10,864 | 9,321 | 8,236 | 7,393 |
| **Cost (FY 93$)** | | | | | | | | |
| *Recruiting* | $28,093,944 | | | | | | | |
| *Training* | | $400,655 | | | | | | |
| *Compensation*[5] | | $79,869,027 | $67,708,600 | $51,301,679 | $43,570,030 | $38,907,937 | $35,817,937 | $33,469,621 |
| **Total** | $28,093,944 | $80,269,683 | $67,708,600 | $51,301,679 | $43,570,030 | $38,907,937 | $35,817,937 | $33,469,621 |
| **Discount Factor @ 2.5%**[4] | 1.000 | 0.976 | 0.952 | 0.929 | 0.906 | 0.884 | 0.862 | 0.841 |
| **PV Cost Flows** | $28,093,944 | $78,311,885 | $64,446,020 | $47,638,709 | $39,472,296 | $34,388,947 | $30,885,695 | $28,156,829 |
| **PV of 7Yr Life Cycle** | $351,394,326 | | | | | | | |

Table B- 3: Cash Flow Schedule with Present Value Computations for PS and NPS Soldiers

## LCC NPS HIGH QUALITY SOLDIERS

| | Access | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **End of FY Attrition %** | | 6.37% | 20.38% | 24.05% | 18.64% | 17.57% | 14.08% | 36.97% |
| **End of FY Inventory** | 12,500 | 11,704 | 9,319 | 7,077 | 5,758 | 4,746 | 4,078 | 2,570 |
| **Mid-Year Inventory** | | 12,102 | 10,511 | 8,198 | 6,417 | 5,252 | 4,412 | 3,324 |
| **Cost (FY 93$)** | | | | | | | | |
| *Recruiting* | $33,678,719 | | | | | | | |
| *Training*[1] | | $199,485,960 | | | | | | |
| *Compensation*[2,3] | | $10,651,505 | $27,297,783 | $23,596,610 | $19,941,743 | $17,577,133 | $15,714,784 | $13,115,652 |
| **Total** | $33,678,719 | $210,137,465 | $27,297,783 | $23,596,610 | $19,941,743 | $17,577,133 | $15,714,784 | $13,115,652 |
| **Discount Factor @ 2.5%**[4] | 1.0 | 0.976 | 0.952 | 0.929 | 0.906 | 0.884 | 0.862 | 0.841 |
| **PV Cost Flows** | $33,678,719 | $205,012,161 | $25,982,423 | $21,911,798 | $18,066,235 | $15,535,624 | $13,550,809 | $11,033,742 |
| **PV of 7Yr Life Cycle** | $344,771,512 | | | | | | | |

## LCC NPS LOW QUALITY SOLDIERS

| | Access | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **End of FY Attrition %** | | 12.68% | 39.04% | 38.67% | 27.14% | 21.42% | 17.29% | 40.40% |
| **End of FY Inventory** | 12,500 | 10,915 | 6,654 | 4,081 | 2,973 | 2,336 | 1,932 | 1,152 |
| **Mid-Year Inventory** | | 11,707 | 8,784 | 5,367 | 3,527 | 2,655 | 2,134 | 1,542 |
| **Cost (FY 93$)** | | | | | | | | |
| *Recruiting* | $22,996,750 | | | | | | | |
| *Training*[1] | | $192,986,326 | | | | | | |
| *Compensation*[2,3] | | $10,238,604 | $21,565,199 | $14,230,260 | $9,936,983 | $8,024,040 | $6,774,756 | $5,287,630 |
| **Total** | $22,996,750 | $203,224,930 | $21,565,199 | $14,230,260 | $9,936,983 | $8,024,040 | $6,774,756 | $5,287,630 |
| **Discount Factor @ 2.5%**[4] | 1.000 | 0.976 | 0.952 | 0.929 | 0.906 | 0.884 | 0.862 | 0.841 |
| **PV Cost Flows** | $22,996,750 | $198,268,225 | $20,526,067 | $13,214,211 | $9,002,416 | $7,092,082 | $5,841,851 | $4,448,299 |
| **PV of 7Yr Life Cycle** | $281,389,901 | | | | | | | |

Notes: 1. Assume all NPS enlistees attend BT, AIT, or OSUT during the first year for six months

2. Assume NPS enlistees drill with pay for 1/2 of the first year (24 drill periods) and do not attend Annual Training
3. Assume all soldiers attend 48 drill periods and 14 days of Annual Training each year (except for NPS the first year).
4. Real discount rate taken from OMB Circular No. A-94 valid through Feb. 95 [Ref. 20].
5. Assume PS soldiers attend 48 drill periods and 14 days of AT each year including the first year.

Table B-4: Cash Flow Schedule with Present Value Computations for High and Low Quality NPS

# HANDS ON PERFORMANCE TEST (HOPT) CONVERSIONS

**Mean HOPT Scores by Aptitude and Job Experience Levels for 30 Jobs From Ref. [5]**

| Job Experience (Months) | | I-II | IIIA | IIIB | IV |
|---|---|---|---|---|---|
| 0-12 | Mean | 49.3 | 45.6 | 43.7 | 39.7 |
| | SD | 9.5 | 10.0 | 8.6 | 9.0 |
| | N | 192.0 | 144.0 | 284.0 | 98.0 |
| 13-24 | Mean | 52.0 | 48.8 | 47.7 | 46.1 |
| | SD | 9.4 | 9.6 | 9.6 | 9.5 |
| | N | 1,452.0 | 1,046.0 | 1,244.0 | 525.0 |
| 25-36 | Mean | 53.2 | 50.5 | 49.9 | 47.1 |
| | SD | 9.3 | 9.9 | 9.4 | 9.5 |
| | N | 680.0 | 547.0 | 655.0 | 213.0 |
| 37+ | Mean | 54.6 | 52.5 | 50.8 | 48.9 |
| | SD | 8.5 | 9.5 | 9.5 | 8.3 |
| | N | 660.0 | 395.0 | 525.0 | 125.0 |
| | Mean | 52.6 | 49.8 | 48.4 | 46.0 |
| Total | SD | 9.5 | 10.0 | 9.7 | 9.6 |
| | N | 2,984.0 | 2,132.0 | 2,708.0 | 961.0 |

**Average HOPT Scores for High and Low Quality Soldiers**

| | Years of Experience | | | | | | |
|---|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 |
| CAT I-IIIA | 47.45 | 50.40 | 51.85 | 53.55 | 53.55 | 53.55 | 53.55 |
| CAT IIIB-IV | 41.70 | 46.90 | 48.50 | 49.85 | 49.85 | 49.85 | 49.85 |

**Mean HOPT Scores for CATs Converted to Performance Factors**

| | Years of Experience | | | | | | |
|---|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 |
| High Quality (CAT I-II + IIIA) | 0.886 | 0.941 | 0.968 | 1.000 | 1.000 | 1.000 | 1.000 |
| Low Quality (CAT IIIB + IV) | 0.779 | 0.876 | 0.906 | 0.931 | 0.931 | 0.931 | 0.931 |

Table B- 5: Mean Hands On Performance Test Scores Converted to Effectiveness Factors

## LCC FOR NPS HIGH QUALITY SOLDIERS WITH PERFORMANCE ADJUSTED MAN-YEARS

| | Access | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **End of FY Attrition %** | | 6.37% | 20.38% | 24.05% | 18.64% | 17.57% | 14.08% | 36.97% |
| **End of FY Inventory** | 12,501 | 11,705 | 9,319 | 7,078 | 5,758 | 4,746 | 4,078 | 2,571 |
| **Mid-Year Inventory** | | 12,103 | 10,512 | 8,199 | 6,418 | 5,252 | 4,412 | 3,324 |
| **Performance Factor** | | 0.886 | 0.941 | 0.968 | 1.000 | 1.000 | 1.000 | 1.000 |
| **Perf. Adj. Inventory** | | 10,724 | 9,894 | 7,938 | 6,418 | 5,252 | 4,412 | 3,324 |
| **Cost (FY 93$)** | | | | | | | | |
| *Recruiting* | $33,681,413 | | | | | | | |
| *Training*[1] | | $199,501,919 | | | | | | |
| *Compensation*[2,3] | | $10,652,357 | $27,299,967 | $23,598,498 | $19,943,339 | $17,578,539 | $15,716,041 | $13,116,701 |
| **Total** | $33,681,413 | $210,154,276 | $27,299,967 | $23,598,498 | $19,943,339 | $17,578,539 | $15,716,041 | $13,116,701 |
| **Discount Factor @ 2.5%**[4] | 1.0 | 0.976 | 0.952 | 0.929 | 0.906 | 0.884 | 0.862 | 0.841 |
| **PV Cost Flows** | $33,681,413 | $205,028,562 | $25,984,501 | $21,913,551 | $18,067,681 | $15,536,867 | $13,551,893 | $11,034,625 |
| **PV of 7Yr Life Cycle** | $344,799,094 | | | | | | | |

## LCC FOR NPS LOW QUALITY SOLDIERS WITH PERFORMANCE ADJUSTED MAN-YEARS

| | Access | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **End of FY Attrition %** | | 12.68% | 39.04% | 38.67% | 27.14% | 21.42% | 17.29% | 40.40% |
| **End of FY Inventory** | 12,501 | 10,916 | 6,655 | 4,081 | 2,974 | 2,337 | 1,933 | 1,152 |
| **Mid-Year Inventory** | | 11,708 | 8,785 | 5,368 | 3,527 | 2,655 | 2,135 | 1,542 |
| **Performance Factor** | | 0.779 | 0.876 | 0.906 | 0.931 | 0.931 | 0.931 | 0.931 |
| **Perf. Adj. Inventory** | | 9117.5 | 7694.2 | 4861.7 | 3283.7 | 2471.7 | 1987.1 | 1435.7 |
| **Cost (FY 93$)** | | | | | | | | |
| *Recruiting* | $22,998,590 | | | | | | | |
| *Training*[1] | | $193,001,765 | | | | | | |
| *Compensation*[2,3] | | $10,239,424 | $21,566,924 | $14,231,398 | $9,937,778 | $8,024,682 | $6,775,298 | $5,288,053 |
| **Total** | $22,998,590 | $203,241,188 | $21,566,924 | $14,231,398 | $9,937,778 | $8,024,682 | $6,775,298 | $5,288,053 |
| **Discount Factor @ 2.5%**[4] | 1.000 | 0.976 | 0.952 | 0.929 | 0.906 | 0.884 | 0.862 | 0.841 |
| **PV Cost Flows** | $22,998,590 | $198,284,086 | $20,527,709 | $13,215,268 | $9,003,137 | $7,092,650 | $5,842,318 | $4,448,655 |
| **PV of 7Yr Life Cycle** | $281,412,412 | | | | | | | |

Notes:
1. Assume all NPS enlistees attend BT, AIT, or OSUT during the first year for six months
2. Assume NPS enlistees drill with pay for 1/2 of the first year (24 drill periods) and do not attend Annual Training
3. Assume all soldiers attend 48 drill periods and 14 days of Annual Training each year (except for NPS the first year).
4. Real discount rate taken from OMB Circular No. A-94 valid through Feb. 95 [Ref. 20].
5. Assume PS soldiers attend 48 drill periods and 14 days of AT each year including the first year.

Table B-6: Example of Cash Flow Schedule with Performance Adjusted Man-Years

**Seven Year Life Cycle Cost in FY94 Constant Dollars**

| | % | Accessions | LCC (Million $) | Man-years | LCC/Man-year ($) |
|---|---|---|---|---|---|
| **NPS** | 50% | 25,001 | $625 | 83,300 | $7,501 |
| **PS** | 50% | 25,001 | $351 | 91,362 | $3,846 |
| **Total** | 100% | 50,002 | $976 | 174,662 | $5,589 |

**Discount Rate =** 2.50%

| | |
|---|---|
| Variance | $624,851,567 |
| Reference | $624,826,574 |
| **MLCC NPS** | $24,993 |
| Variance | $351,394,326 |
| Reference | $351,380,271 |
| **MLCC PS** | $14,055 |

Table B-7: Example of Life Cycle Cost-Effectiveness Model Output

Notes: The boxed areas indicate user inputs. All cost and man-year figures are calculated using the data in Tables B-1 through B-3.

The marginal life cycle cost (MLCC) calculations show the cost of accessing one more NPS soldier and one more PS soldier.

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